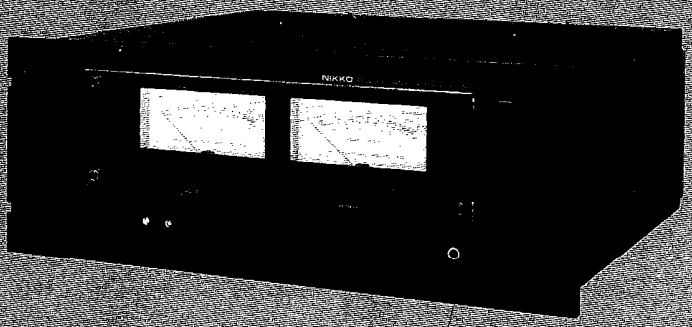
ALPHA-VI

STEREO POWER AMPLIFIER



TYPE AND VOLTAGE

W-TYPE UL and CSA type	120V AC
E-TYPE NK-STD type	220/240V AC
N-TYPE DEMKO and SEMKO type	

SERVICE MANUAL

CONTENTS

SPECIFICATIONS

AMPLIFIER SECTION ★ --- Canadian model only.

Continuous Power Output per channel:
- 20 ~ 2000 Hz (8 ohms) . . . . . more than 300 Watts
- 20 ~ 2000 Hz (4 ohms) . . . . . more than 330 Watts
- 1000 Hz (8 ohms) . . . . . more than 340 Watts
- 1000 Hz (4 ohms) . . . . . more than 340 Watts
- ★1000 Hz (16 ohms, BTL) . . . . . more than 700 Watts
- 1000 Hz (8 ohms, BTL) . . . . . more than 650 Watts
- 1000 Hz (4 ohms, BTL) . . . . . more than 660 Watts

T. H. Distortion, 8 ohms:
- at Continuous Power Output . . no more than 0.008%
- at 1 Watt Power Output . . . . . no more than 0.02%

T. H. Distortion, 4 ohms:
- at Continuous Power Output . . . no more than 0.02%

★T. H. Distortion, 16 ohms, BTL:
- at Continuous Power Output . . no more than 0.008%

T. H. Distortion, 8 ohms, BTL:
- at Continuous Power Output . . . no more than 0.02%

T. H. Distortion, 4 ohms, BTL:
- at Continuous Power Output . . . no more than 0.1%

I. M. Distortion, 8 ohms:
- at Continuous Power Output . . . no more than 0.01%
- at 1 Watt Power Output . . . . . no more than 0.02%

IHF Power Bandwidth, 8 ohms: . . . . . 10 ~ 40000Hz

Damping Factor at 1000 Hz, 8 ohms: . . . . more than 150

Frequency Response, "NORMAL" input, 8 ohms:
- at 1 Watt Power Output . . . . . 25 ~ 100000Hz ± 2 dB

Input Sensitivity for 300 Watts Power Output:
- MAIN IN . . . . . 1V ± 1.5 dB

Signal to Noise Ratio, IHF "A" Network:
- MAIN (NORMAL, DIRECT) . . . better than 115 dB

Signal to Noise Ratio, DIN Filter:
- MAIN IN (NORMAL, DIRECT) . . better than 90 dB

Subsonic Filter ("NORMAL" input):
- at 15Hz . . . . . –3dB ± 2 dB

Channel Balance: . . . . . no more than 1 dB

Residual Hum and Noise, 8 ohms: . . no more than 0.3 mV

Idling Current: . . . . . 50 ~ 120 mA

Midpoint Voltage: . . . . . 0 ± 100 mV

Muting Delay Time: . . . . . 3 ~ 9 Seconds

GENERAL

Power Requirement:
- W-TYPE . . . . . AC 120V, 60Hz
- E, N-TYPE AC220/240V, 50/60Hz

Power Consumption: . . . . . 1 KW (1.4 KVA)

Ambient Temperature during Operation: . . . –10 ~ 30°C

Dimensions:
- Width . . . . . 482 mm (19 inches)
- Height . . . . . 182 mm (7 1/4 inches)
- Depth . . . . . 465 mm (18 5/16 inches)

Weight, without package: . . . . . 27,5 kg (60.5 lbs)

*Specifications are subject to change without notice.

CIRCUIT DESCRIPTION

The electric circuit of the ALPHA-VI can be broken up into four main sections as the power amplifier sections, the power source sections, the protection circuits, and the meter amplifier section. The most parts of these circuits is built in to ten sheets of PCB (printed circuit board) forms the stereo power amplifier which is characterized by large output power and low distortion with two independent large capacity toroidal power transformers, four large capacity filter capacitors and the other parts. As the ALPHA-VI has such a large output as 300W + 300W, it produces much heat and the chance of the amplifier being destroyed by uncalculated accidents is high.
Therefore, we have considered this very seriously in the case of business use - - - the unit provides a cooling fan, the protection circuits was improved - - - etc.

1. The Power Amplifier

The power amplifier of the ALPHA-VI is a DC amplifier which provides a constant amplification level not only for the audio signal but also for DC. As this means that it keeps the output impedance low even down not only does it hold the audio frequency band, but also to DC, the speaker can be damped effectively down to the ultra low frequency. Also, as the reproduction of the envelope element of the music signal is possible the music atomosphere of the place is not spoiled. Moreover, as there is no capacitor in the coupling part or the NFB loop, the phase characteristic in the low frequency is improved and the distortion and the deterioration of the sound quality due to the capacitor are avoided.
But even though in the DC amplifier, since it is an amplifier for audio use, DC itself should not be input. Also, if the rumble noise due to the eccentricity of the disc records and the warp are not input into the amplifier, the reproduced music is much clearer. So for this reason, a subsonic filter is provided in the input section in the ALPH-VI. The cut-off frequency of this filter is determined by the capacitor C901 (C902) in the Input PCB and the input impedance of the amplifier and it is about 15 Hz. As the signal flows into the capacitor for the filter use, a good quality polyester film capacitor has been used to avoid any deterioration of the music.
Further, it is possible to apply the input signal directly into the amplifier bypassing the subsonic filter by controling the switch of the rear panel, but adjustment of the input sensitivity cannot be done in this case.

(a) The voltage amplification stage

The voltage amplification stage of ALPHA-VI is a circuit consisting of a 2 stage-differential amplifier. The first stage is a differential amplifier using a low noise N-channel dual FET of high g_m. The FET used in the first stage is molded into one package from two FETs chosen to maintain the internal transconductance (g_m), the drain current (I_{DSS}) and the gate-cource voltage (V_{GS}) very well. As the pair characteristic is excellent against the changes in the surrounding temperature, it is a very suitable FET for first stage amplifier. By adopting this FET in the ALPHA-VI, the DC balance is very stable and the DC voltage drift is kept small even though the gain is large.
Further, the first stage is a circuit which can improve the distortion and the frequency response of the high frequency by compressing the Miller effect of the FET as cascade connection. The DC balance control circuit is inserted into the positive side of this stage and it thus becomes possible to control the balance coursely and very finely.
The second stage is the differential amplifier useing the PNP transistors which form the current mirror load. Using the current mirror load instead of the resistor load, the gain is twice as much as that of the resistor load differential amplifier. Also, as a kind of push-pull operation between the differential amplifier circuit and the current mirror circuit occurs, there is the advantage of the even order harmonics being cancelled. In this second stage, the improvement of the distortion and the frequency response due to the high frequency were considered in adopting the cascade connection. Also, in this stage, the transistor for the bias used, Q9, is connected. By controlling the semi fixed resistor connected to the base of Q9, the idling current of the output stage is set. This transistor is fixed to the heat sink of the output stage, it detects the temperature of the heat sink so as to maintain the temperature. Further, the Varistor (diode) D707 between the collector and base of this transistor is fixed to the heat sink of the drive transistor Q718 and it also detects the temperature. So the temperature change of both the drive transistor and the output transistor is fed back, and thus the stability toward temperature has become excellent. Further, the Z-pole compensating is adopted for the phase compensating and on the whole, a voltage amplifier stage with high stability, high speed response and low distortion has been constructed.

(b) The output stage

To obtain enough power gain over the wide band, a 3 stage Darlington pure complimentary OCL circuit using high f_T transistors has been constructed. The four pair parallel connection is adopted so that the output transistor can take out the high power easily. In the output stage, because of the carrier strage effect due to the base range of the transistor, the rising and the falling of the signal are delayed and then a trouble phenomenon which appears as distortion occurs. For the ALPHA-VI, the circuit construction and the values of the constants which can discharge the strage carrier very quickly are chosen,

but the constant voltage circuit due to the transistor is inserted into the base circuit of the output transistor in which this phenomenon is observed most remarkably. The impedance of this circuit is much lower than that of the series connection of the ordinary diode and resistor. This means that the discharge impedance of the strage carrier is small and thus the discharging time of the strage carrier is reduced. So because of the above, the output stage has the character of low distortion of a good high-speed response.

(c) About the BTL connection

The ALPHA-VI can be used as the monaural power amplifier if necessary. In this case, the output power is 650 W (when the load is 8 ohm) but the output becomes not stereo but monaural. By turning the STEREO-MONO switch (S4) at the rear panel into "MONO", the inside circuit is in the BTL connection. Then in the circuit of the amplifier some part of the output of the left channel is input into the inverting input terminal of the right channel and it is constructed such that the non-inverting input terminal of the right channel grounds and shorts. Now, for example, considering that the signal is input into the input terminal of the left channel, the signal which receives amplification is output from the speaker terminal, as some part of the signal is added to the inverting input terminal of the right channel through the resistor R760, the output signal appeares in the speaker terminal of the right channel. But as the input signal of the right channel is added to the inverting input terminal, the phase of the output signal is opposite in contrast with that of the left channel. So, when the speaker is connected between the speaker terminals of the right and the left channels, the synthesized output power of the right and the left channels is obtained. This is the action of the BTL connection.

2. The Electric Source Section

The electric sources of each part of the ALPHA-VI are supplied from two completely independent large capacity toroidal power transformers. If the electric source is divided into each use, we have: the output stage use, the voltage amplification stage use, the protection circuit use (including the meter amplifier section) and the lamp use.

(a) The electric power source for the output stage use

The electric power source for the output stage use is supplied from one each for the left and the right channels, that is, two toroidal transformers if both of the right and the left channels are considered together. After each of the AC electric source from two transformers are rectified in the large capacity silicon diode bridge ~~form~~, they are also smoothed in the large capacity filter capacitor, and then they are guided to each of the output stages. For all this process, as large an output as 300W + 300W can be supplied sufficiently due to the large scale electric source circuit.
When a signal is not applied to the amplifier, the voltages of this electric source are about +94 and −94V.

(b) The electric source for the voltage amplification stage use

The electric source for the voltage amplification stage use is supplied from one of two toroidal transformers. After this, the AC electric source is rectified into the REG (A) PCB, and it is supplied into the amplifier section through the regulator circuit. To make a power amplifier with a high S/N ratio with a wide band and highly stable, the electric power sources, especially the one for the voltage amplification stage use, should be of good quality.
Generally, the high quality electric power source means that the internal impedance of the electric source (the output impedance) is low over the wide frequency range. To actualize this in the voltage regulator, and effective method is to make the voltage gain of the error amplifier high and to make the h_{FE} of the control transistor as large as possible. In the ALPHA-VI, using the constant current circuit due to the FET, instead of the commonly used resistor, for the load of the error amplifier, a gain several times larger than the circuit of the resistor load can be obtained and the control transistor connected in the Darlington connection form, totally makes h_{FE} large. Also, to avoid the frequency response of the error amplifier getting whorse in the high frequency, a high range compensating capacitor is added to the error amplifier and a polyester film capacitor with good quality frequency characteristics is connected to the output of the regulator circuit. Thusly an electric source which has a very low impedance over a wide frequency range is provided.

(c) The electric source for the protection circuit use

The electric source for the protection circuit use is supplied from the electric source for the left channel output stage due to the REG (B) PCB. The voltages required for the action of the protection circuit and the relay drive is reduced to the necessary amount, through the regulator and then electrical power is distributed to each part of the circuit.
The voltages after passing through this regulator becomes ±29V and −30.5V. +29V is supplied to the protection circuit and the meter amplifier section and −30.5V is also supplied to the meter amplifier

section.
The circuit of the regulator is simple, but it also contains the Darlington connection. Also, the positive side of the electric source, which has many relays and driving circuits, contains the hanging type short circuit protection circuit and forced air cooling for the control transistors.

(d) The electric source for the lamp use

The electric source for the lamp use is supplied from one of the two toroidal transformers. This electric source which first goes to the METER AMP PCB is supplied to the meter lighting lamp and is also rectified, passing through the PROTECT (B) PCB, it is used as the negative electric source for the protection circuit use.

3. The Protection Circuit

Very carefully considering the response from business use, the protection circuit keeping the circuits, parts and speakers out of these destroyed by the rush current, heat and short circuiting of the load over a wide range.
Compared with the ordinary power amplifier which provides only a protection circuit against the short circuiting of the load and the DC output, this circuit is a large scale one.

(a) The protection against the rush current

The ALPHA-VI uses two large capacity toroidal transformers. The toroidal transformer is the closest possible to the ideal of today, but when the power switch is turned on, it having a much larger rush current compared with the ordinal one is a disadvantage. So, when two large capacity transformers are used, the contact of the power switch is deteriorated, or even though the load current does not flow, the primary side fuse can be melted because of the rush current. To avoid this, in the ALPHA-VI, the circuit which reduces the rush current by using a relay with large contact capacity is added.
When the power switch is turned on, the resistors (R853, 854) are set in series in the primary side, so that the rush current is reduced. The output of the secondary side of the transformer is rectified in the diode D823 which is mounted to the REG (B) PCB and then is smoothed at the resistor R855 and the capacitor C827. Thus the relay RY6 is driven. As the smoothing circuit of R855 and C827 has a natural time constant, after the power switch is turned on the relay is turned on after a small delay. But at this point, as the period of the rush current has already been completed, the constant current has already flown to the transformer. When the relay RY6 is turned on, the resistors, R853 and R854, which are set in series in the primary side of the transformer are forced to short, the circuit of the primary side of the electric source goes into the ordinary state of use.

(b) The protection against the DC output

When DC voltage harmful to the speaker is output, the circuit detects this voltage and breaks the speakers from the amplifier. When the power switch is turned on, it also holds the output muting circuit so as not output a shock noise. This circuit is mounted to the PROTECT (B) PCB. The case when the power switch is turned on, three transistors Q807 ~ Q809 out of the five in the PROTECT (B) PCB are cut off. Though +29V is added to the base of Q810 through the resistor R829 first as this voltage is used to charge the capacitor C809, it is not passed to Q810, so both of Q810, so both of Q810 and Q811 are cut off. So, four relays, RY1 ~ RY4, connected to the collectors of Q810 and Q811 do not operating. Meanwhile, the PROTECT indicator lights up "Red" and the speaker terminals, the meter amplifier and the headphone terminals are broken from the main amplifier output. According to the passing of time the voltages at both ends of C809 go up and when the voltage becomes (zener voltage $+2V_{BE} + V_{D806} = 6.7 \sim 6.9V$), Q810 and Q811 are tuned on, then the relays RY1 ~ RY4 operating. From this result, the PROTECT indicator lights up "Green" and the speaker terminals, the meter amplifier and the headphone terminals are connected to the main amplifier output, at this point, if the speaker switches S2 and S3 are turned off, naturally, the relays RY1 and RY2 do not operating and the speaker terminals are kept cut off from the main amplifier. Due to the manner described above, the shock noise involved when the power switch turned on is not output to the speaker. When the power switch is turned off, the negative electric source supplied to the circuit becomes 0 V at once, since the capacity of the filter capacitor C806 is very small. The negative electric power source is supplied to the base of Q809 through the resistor R828, but usually cancelling with the negative electric power source, the base voltage of Q809 is about −3.8V, so Q809 is cut off. Now, as the negative electric power source becomes 0 V, the voltage, at the base of Q809 is changed into a positive voltage, and so Q809 is turned on and the charge voltage of the capacitor C809 is discharged, so that Q810 and Q811 are cut off and the relays RY1 ~ RY4 are turned off. These action occur very quickly, so that as soon as the power switch is turned off, the relays are turned off.
Therefore, no shock noise is involved from the speaker. The ditection of the DC voltage is taken care of by the transistors Q807 and Q808. The output of the main amplifier goes into the PROTECT (B) PCB via the PROTECT (A) PCB and passing through

the resistors R831 and R832 is added to the bases of two transistors. The resistors R830, R832 and the capacitor C807 and C808 form the time constant, which avoide taking protective action against the AC signals. In the case when the DC voltage appears in the output of the main amplifier, if the voltage is the positive, Q808 detects it. In both cases when the voltage between the base emitter of the transistors becomes more than ±0.6 V, one of the transistors is turned on, it detects that the DC voltage is output. In the case as positive voltage Q808 is turned on, as the charge voltage of the capacitor C809 discharges, Q810 and Q811 are cut off and then the relay RY1 ~ RY4 are turned off.

In the case of the negative voltage, as Q807 is turned on and the negative electric power source which supplies the protection circuit grounds and shorts, the base voltage of Q809 is changed into the positive voltage, and Q809 is turned on, then, the charge voltage of the capacitor C809 is discharged. These operating are the action of the protection circuit against the output of the DC voltage and while operating the speaker, the headphones and the meter amplifier are cut off from the main amplifier and the protect indicator lights up "Red".

(c) The protection against the excessive current

If while the main amplifier is operating the speaker or the speaker cord is short, or the low impedance load is driven by a large output of electrical power, large excessive current flows in the output stage of the main amplifier. If this condition is left for a while, it might cause destruction of the output transistor. So, to protect from such an accident, the ALPHA-VI detects the emitter current of the output transistor and uses the Pc limiter circuit, which limits the loss in the collector of the output transistors and put the relay to be operating, then cuts off the speaker from the output of main amplifier through the excessive load detection circuit. Thusly, two stage structure of protection is provided for protection of the output transistor and expected that perfectly protecting operation. The Pc limiter circuit is built in the MAIN AMP PCB of the left and the right channels, and the limiting levels are controlled independently for each of the peaks of the positive side and the negative side of AC input signal to the output stage. The detection of the current flowing in the output transistor is performed by utilizing the voltage drop that occurs in the resistors R747 ~ R754 connected to the emitters of the output transistors. These voltages are each collected in the positive side and the negative side and are sent to the base of the transistor Q713 (Q715) in the Pc limiter circuit. The Pc limiter circuit has two transistors each in the positive side and the negative side to compose a PNPN construction and they operating similarly to an SCR. When the current which exceeds the limiting level flows into the output transistor, the Pc limiter circuit is turned on and the input signal to the output stage is directed to the mid-point of the amplifier and thus limits the input. The control of the limiting level is done at the semi fixed resistor connected to the base of the transistor Q713 (Q715) in the Pc limiter circuit. This Pc limiter circuit functions mainly when the low impedance load is driven by large output electrical power.

The excessive load detection circuit is built in the PROTECT (A) PCB. The detection of excessively large currents at the output stage is also made by utilizing the voltage drop that occurs in the emitter resistors of the output transistor Q4 is used. The voltages of the emitter resistors of the output transistor Q4 in the left and right channels are sent to the bases of the transistors Q824 and Q826 of the PROTECT (A) PCB. When the current of the output stage flows excessively, the voltages of the emitter resistor of the output transistor increase, and then Q824 (Q826) are turned on. Then as the current flows from the base of the transistor Q825 of the PROTECT (A) PCB to the collector of Q824 (Q826), Q825 is also turned on. Therefore, the positive voltage is sent from the collector of Q825 to the base of the transistor Q809 of the PROTECT (B) PCB, then Q809 is turned on and the charge voltage of the capacitor C809 is discharged and Q810 and Q811 are cut off, then the relays RY1 ~ RY4 are turned off. Therefore, this equal to the protection operating for the DC voltage output. The excessive load detection circuit is mainly operated when the short circuits of the speaker and speaker cords occurs.

(d) The protection against excessive heat

As the ALPHA-VI is a power amplifier of large output power capability, much heat is released. Therefore, using the electric fan, the heat sink which is the main heat source, is forced air cooled, but a protection circuit is also provided for the case when the fan is broken, the draft holes of the amplifier are blocked, or the excess heat cannot be taken away using only the fan. The detection of the temperature is done by five thermostats affixed to the heat sink and the protection operating with three stages due to the temperature is facilitated.

The first stage of the excess heat protection starts when the heat sink temperature gets to 100°C. Before then, the cooling fan rotates in slow speed, since the resistors are set in series. When the heat sink temperature gets to 100°C, the thermostat (100°C) is turned on, then the relay RY7 is turned on.

Therefore, as the fan is connected directly to the electric source, it rotates at high speed and the efficiency of the cooling system increases. Further, in the case of the European model, the total resistance of the series resistors of the fan become lower, forcing the fan to rotate at high speed.

The second stage begins when the heat sink temperature gets to 120°C. Two of the thermostats which works in this case are used in parallel and are mounted at different points. So whenever one of them gets to 120°C, the protection operating of the second stage starts. When the heat sink temperature gets to 120°C, these thermostats TH1 (120°C) are turned on. Then the electric power source passes the contact point of the resistor R811 of the METER AMP PCB and the relay RY4 and is thus connected to the non-stable multi vibrator circuit through the thermostat. The transistors Q804 and Q805 of the non-stable multi vibrators alternatively turn on and off, so the HI-TEMP indicator connected to the collector of Q805 starts turning on and off and so it warns that the inside of the ALPHA-VI has become very hot.

The third stage starts when the heat sink temperature gets to 130°C. There are also two thermostats operates in this case, and as we saw in the second stage, whenever one of the thermostats is turned on, the protection operating is performed. When this thermostat TH2 (130°C) is tuned on, the current flows to the base of the transistor Q804 of the non-stable multi vibrator of the METER AMP PCB through the diode D810 and the thermostat TH2 from the transistor Q825 of the PROTECT (A) PCB. So, as Q825 turned on and the positive voltage is sent to the base of the transistor Q809 of the PROTECT (B) PCB, Q809 is turned on and the charge voltage of the capacitor C809 is discharged. Q810 and Q811 are cut off and the relays RY1 ~ RY4 are turned off. On the other hand, as the current is sent to Q804 of the non-stable multi vibrator, the multi vibrator stops turning off and on alternatively leaves both transistors Q804 and Q805 in the state of ON, the HI-TEMP indicator is continuously alight, instead of turning on and off.

4. The Meter Amplifier Section

The meter amplifier section has only one IC in its circuit and it is built in the METER AMP PCB. The IC801 (TA7318P) has a two channel capability for wave detection and a 1/4 power compression meter drive use DC amplifier (including the hold motion) inside. The meter can be set in the wide range through the 1/4 power compresser, and then it can indicate from small output power to large output power without changing the range.

The capacitor connected to the pin 3 and pin 7 of the IC decides the recovery time of the meter. Also, the thermistor inserted in the input circuit of IC make compensation for the temperature characteristics and avoids changes in the indicated value of the meter due to changes in the surrounding temperature.

The large size ALPHA-VI, peak power meter, is driven with such a reliable circuit as described above.

DISASSEMBLY

CABINET COVER REMOVAL

a. Remove six tapping screws (#1 ~ #6) from the top of the unit as shown in Photo 1.

b. Remove four screws from both sides of the unit. (Left side screws are shown as #7 and #8 in Photo 1.)

c. Lift the cabinet cover away from the unit.

BOTTOM PLATE REMOVAL

a. Remove ten tapping screws (#1 ~ #10) from the bottom of the unit as shown in Photo 2.

FRONT PANEL REMOVAL

a. Remove one knob (POWER) from the front panel by pulling it forward.

b. Remove four tapping screws (#1 ~ #4) from the left side of the unit as shown in Photo 3.

c. Similarly remove four tapping screws from the right side of the unit.

d. Lift the front panel away from the unit.

POWER TRANSFORMERS REMOVAL

a. Disconnect all the cables from the power transformer.

b. Remove four screws (#1 ~ #4; Photo 4) for right channel power transformer removal.

c. Similarly remove four screws (#5 ~ #8; Photo 4) for left channel.

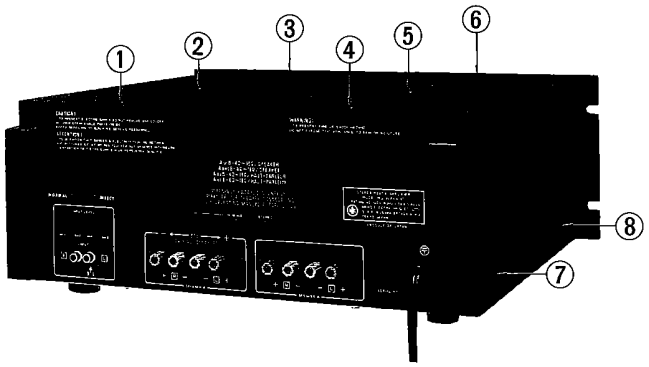


Photo 1

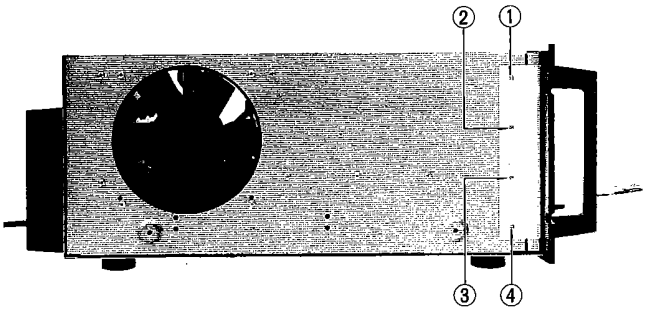


Photo 3

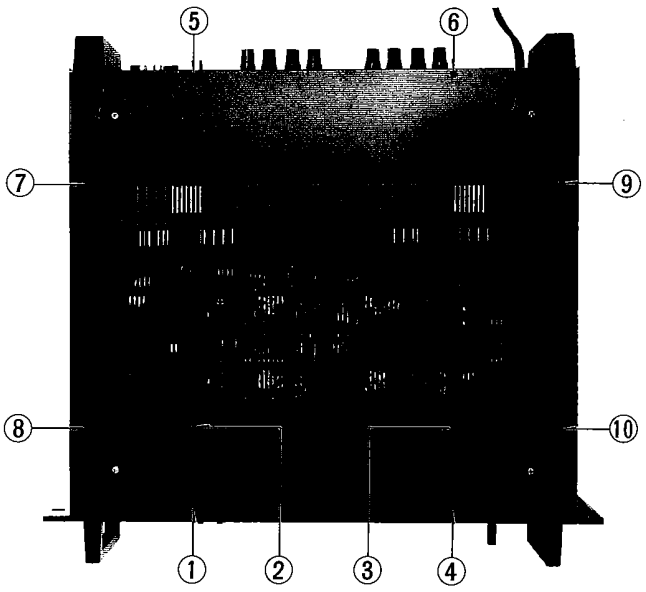


Photo 2

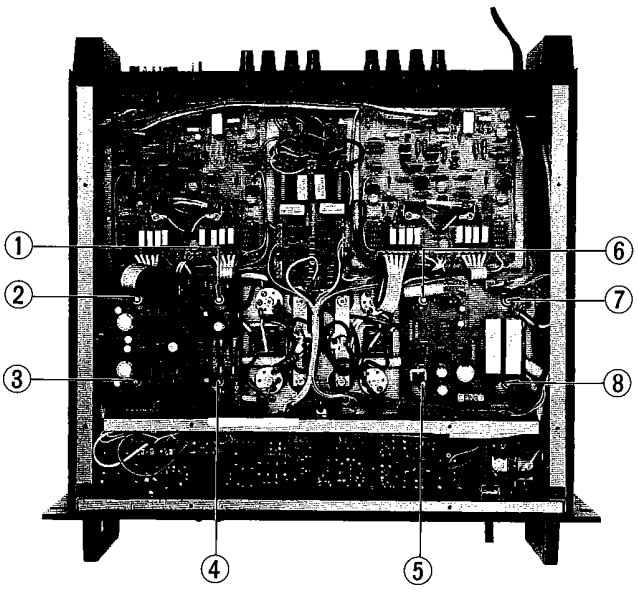


Photo 4

ALIGNMENT

ALIGNMENT PRECAUTIONS

1. As the ALPHA-VI is a power amplifier with large output power, it consumes much electrical power and a great amount of current flows in the power source line of the primary side. Therefore, in the case when it is connected to the source by an extension cord, the size of the extension cord should be equalor larger than that of the power source cord of the ALPHA-VI. Otherwise, the voltage might be reduced or the extension cord might generate excessive heat because of the resistance which the cord has, then not only can proper alignment be done, but also it is very dangerous.

2. If the power sources are supplied to the ALPHA-VI and the instruments by branching off from one cord, the voltage is sometimes dropped down and the stability of the instruments goes down.
   The ALPHA-VI and the instruments should be connected to the power sources by using independent cords. The ALPHA-VI must take the power source from AC outlet of the wall side.

3. As there are many parts which hold high voltages in the circuit and the parts inside of the ALPHA-VI, be careful not to receive an electric shock. In the case of connecting and taking off the instruments, you must turn off the power switch of the ALPHA-VI before getting on the work.

4. When the circuit happens to be shorted by the drivers or test probes used for alignment through mistake, the circuit and the parts will be damaged. As the damage is larger than that of ordinary amplifiers and receivers, close attention is needed. It is advised that the turning driver, excluding the top part, should be wrapped with insulation tape or a driver made of plastic or some kind of insulating material should be used.

5. As the dummy load resistor generates heat while alignment, it gets very hot and you may be burnt if you touch it with bare hands. It is better if you can put the dummy load resistor in a place away from being touched, but the wire between the dummy load resistor and the amplifier should not be long. Contrive some method, like putting the dummy load resistor in a well ventilated box. Further, as more than 10A current might flow in the wire connecting the dummy load resistor and the amplifier, at least larger than AWG #18 thick wire should be used.

6. The fan is mounted in the ALPHA-VI for cooling. As this fan rotates while the power source is on, be careful not to be hurt by touching it.

7. The right and the left channels in the ALPHA-VI have one MAIN AMP PCB for each, but they are the same for the left and the right channel, except in some small places. In the method of alignment described in the following, the alignment of the MAIN AMP PCB, as long as no notice is mentioned, is done the same for the left and the right channels. The symbol numbers of the semi fixed resistors and the wiring terminal numbers are the same for both the left and the right channels.

8. The alignment cannot be done in the condition of BTL operation. On alignment, the MONO/STEREO switch in the center part of the rear panel must be set in the "STEREO" position.

9. The slide switch above the "INPUT LEVEL" volume in the rear panel of the amplifier is to be set in the "NORMAL" position. All the adjustments in the following should be done after the slide switch is set in the "NORMAL" position.

TEST EQUIPMENT

Allow a minimum of 10 minutes warm-up for test equipment.
Maintain rated line voltage.

Audio Frequency Generator
Distortion Meter
Osicl1oscope
AC Voltmeter
DC Voltmeter
2-Dummy Load Resistors, 8 ohms, 500 W
2-Dummy Load Resistors, 4 ohms, 500W

All the semi fixed resistors of the MAIN AMP PCB are set around the center position temporarily. (R756, R761, R762, R757, R758 and R759)

CHECKING THE OUTPUT VOLTAGE OF THE VOLTAGE REGULATOR

1. Connect 8 ohms dummy load resistors to the left and right channel speaker terminals.
2. Turn the "INPUT LEVEL" volume controls down to the fully counter clockwise, and set it to "MIN".
3. Connect the DC voltmeter across the wiring terminal 6 and 8 of the REG (A) PCB.
   The terminal 6 is positive side.
4. Turning on the power switch of the ALPHA-VI, make sure that the indication of the DC voltmeter is 96V ± 3V.
   After confirmation, the power switch should be turned off.

5. Connect the DC voltmeter across the wiring terminal 11 and 8 of the REG (A) PCB.
   The terminal 8 is positive side.
6. Turning on the power switch on the ALPHA-VI, make sure that the indication of the DC voltmeter is 95V ± 3V.
   After confirmation, the power switch should be turned off.
7. Remove DC voltmeter.

DC BALANCE ADJUSTMENT

1. Connect the DC voltmeter across the wiring terminal 16 and 21 of the MAIN AMP PCB.
2. Turning on the power switch of the ALPHA-VI.
3. Adjust the semi-fixed resistor R761 for a 0 ± 20 mV DC voltmeter reading.
4. Adjust the semi-fixed resistor R762 for a 0 ± 3 mV DC voltmeter reading.
5. Turning on the power switch, till the DC balance settled down. This takes about 10 minutes. So after adjustment, keep the power switch on for 10 minutes, then make sure the DC balance again. In the case when the indication of the DC voltmeter is not within 0 ± 20 mV, the semi-fixed resistor should be adjusted to make it within the range.
6. Turning off the power switch. Remove DC voltmeter.

IDLING CURRENT ADJUSTMENT

1. The output stage in the ALPHA-VI is a 4 parallel push pull type. Because of the variation of h_{fe} and V_{be} of the transistors, the four pairs, 8 transistors do not have the same values for the idling currents and they are a little different from one another. So, the decision of the idling current should be the average of the idling currents of the four pairs, eight transistors. (See Figure 2)
   (a) Connect the DC voltmeter across the wiring terminal 15 and 16 of the MAIN AMP PCB. The terminal 16 is positive side.
   (b) Turning on the power switch of the ALPHA-VI. Adjust the semi fixed resistor R756 so that the DC voltmeter indicates 20 ~ 22 mV. (Tentative adjustment)
   (c) The voltages between the wiring terminals 16 and 22, 23, 24 and 25 of the MAIN AMP PCB are measured. That is, the voltages between the terminals 16 and 22, 16 and 23, 16 and 24, and 16 and 25, are measured. Omitting the highest and the lowest voltages out of the four measured voltages, the average of the two left is calculated and we call it (α).
   (d) The voltages between the wiring terminals 16 and 12, 13, 14, and 15 of the MAIN AMP PCB are measured. That is, the voltages between the terminals 16 and 12, 16 and 13, 16 and 14, and 16 and 15 are measured. Omitting the highest and the lowest of the four measured voltages, the average of the two left is calculated and we call it (β).
   (e) Comparing the averages (α) and (β), the semi fixed resistor R 756 is adjusted to make the highest voltage value equal to 20 ~ 22 mV.
2. Turning on the power switch, it takes about 15 minutes till the idling current gets settled. After adjusting, leave the power switch on for 15 minutes, then measure the idling current again and make sure that the indication of the DC VOLTMETER is between 25 ~ 33 mV. In the case when the voltage gets too high, there must be some trouble in the circuits or parts.
3. Turning off the power switch of the ALPHA-VI.
4. Remove DC voltmeter and dummy load resistors.

LIMITER CIRCUIT ADJUSTMENT

NOTE: See illustration, Figure 1, for test equipment hook-up.

1. Connect **4 ohms** dummy load resistors to the left and right channel speaker terminals.
2. Connect the AC voltmeter, distortion meter and the oscilloscope to the left (right) channel speaker terminals. Connect the generator to left (right) channel input terminal.
3. Turning on the power switch of the ALPHA-VI.
4. Turn the "INPUT LEVEL" volume control fully clockwise, and set it to "MAX".
5. Set the frequency of the generator to 1KHz. Adjust the output level of the generator so as to make the output power 400 W. (40 V AC voltmeter reading.)
6. Adjust the semi-fixed resistors R757 and R758 so that the upper and the lower side peakes of the output waveform begin to clip.
7. Turning off the power switch. Remove 4 ohms dummy load resistors.

DRIVER CIRCUIT ADJUSTMENT

NOTE: See illustration, Figure 1, for test equipment hook-up.

1. Connect **8 ohms** dummy load resistors to the left and right channel speaker terminals.
2. Connect the AC voltmeter, distortion meter and the oscilloscope to the left (right) channel speaker terminals. Connect the generator to left (right) channel input terminal.
3. Turning on the power switch of the ALPHA-VI.
4. Turn the "INPUT LEVEL" volume controls fully clockwise, and set it to "MAX".
5. Set the frequency of the generator to 20 KHz. Adjust the output level of the generator so as to make the output power 300 W. (49 V AC voltmeter reading.)
6. Adjust the semi-fixed resistor R759 for minimum distortion. It should be at least below 0.008%.
7. Turning off the power switch of the ALPHA-VI.

METER CIRCUT ADJUSTMENT

NOTE: See illustration, Figure 1, for test equipment hook-up.

1. Connect **8 ohms** dummy load resistors to the left and right channel speaker terminals.
2. Connect the AC voltmeter, distortion meter and the oscilloscope to the left (right) channel speaker terminals. Connect the generator to left (right) channel input terminal.
3. Make sure that the zero position of the meter is adjusted when power switch is off. If it is not adjusted, remove a meter cover from front panel, and adjust it to be zero. When adjusting, make sure that you put the amplifier on a horizontal surface.
4. Turning on the power switch of the ALPHA-VI.
5. Turn the "INPUT LEVEL" volume control fully clockwise, and set it to "MAX".
6. Set the frequency of the generator to 1 KHz. Adjust the output level of the generator so as to make the output power 300 W. (49 V AC voltmeter reading.)
7. Adjust the semi-fixed resistors R833 (left channel) and R834 (right channel) of the METER AMP PCB so that the meter indicates 300 W.
8. Turning off the power switch of the ALPHA-VI.
9. Remove all test equipment.

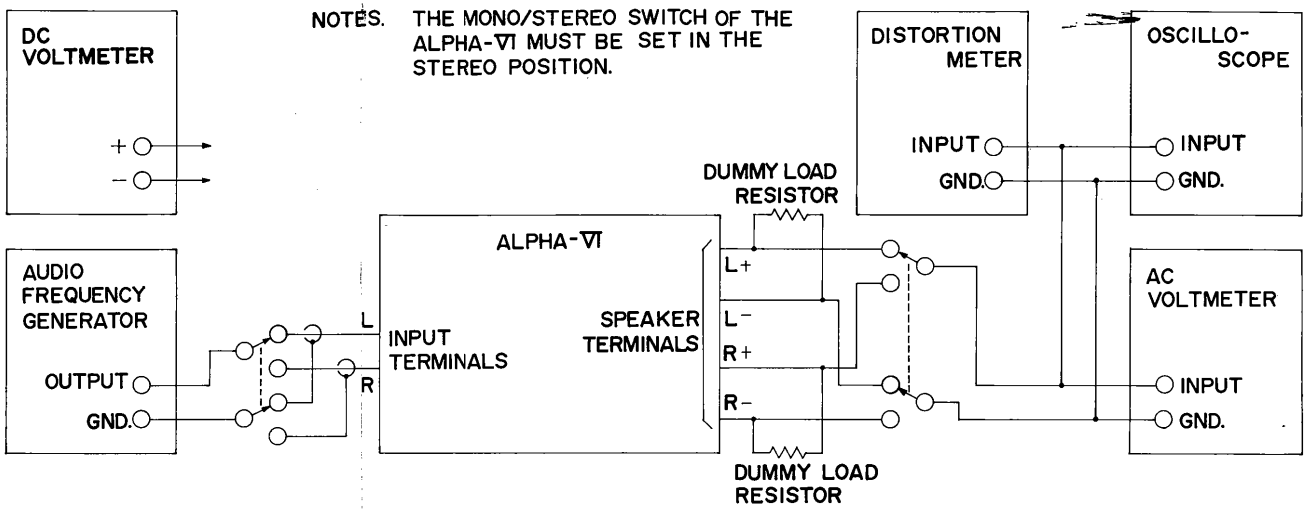


Figure 1 TEST EQUIPMENT HOOK-UP

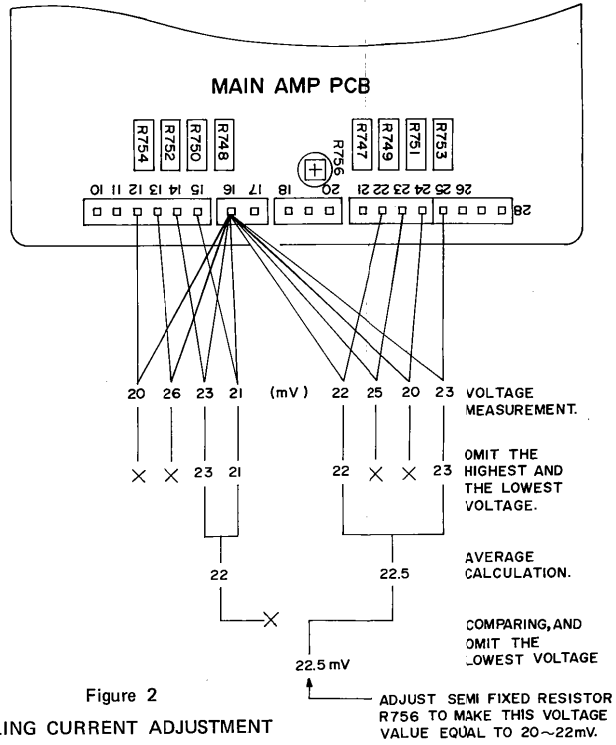
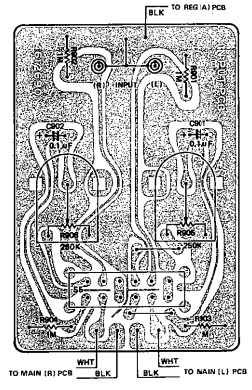
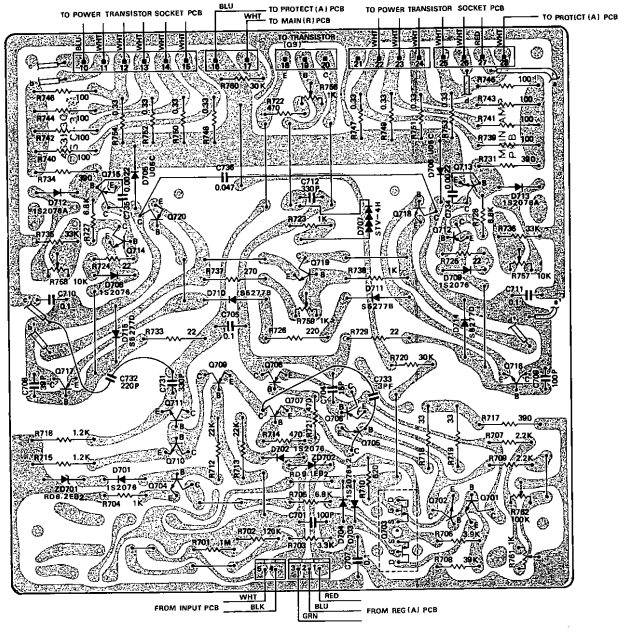


Figure 2
IDLING CURRENT ADJUSTMENT

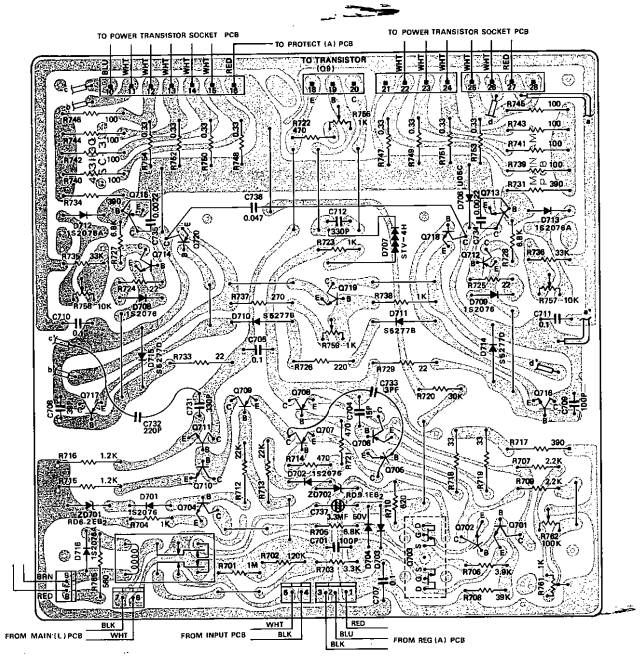
P. C. BOARD (BOTTOM VIEW)



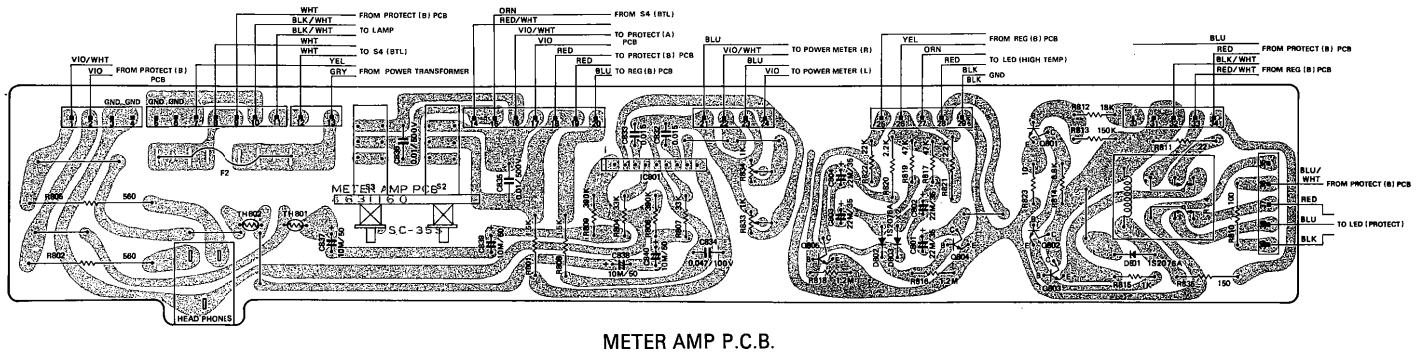
INPUT P.C.B.



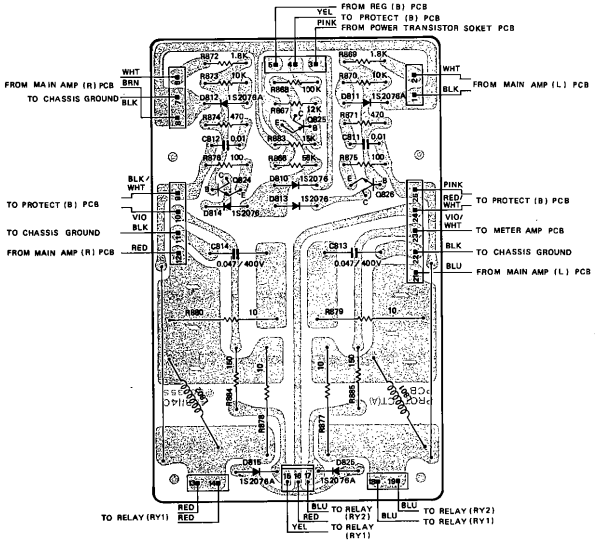
MAIN AMP (L) P.C.B.



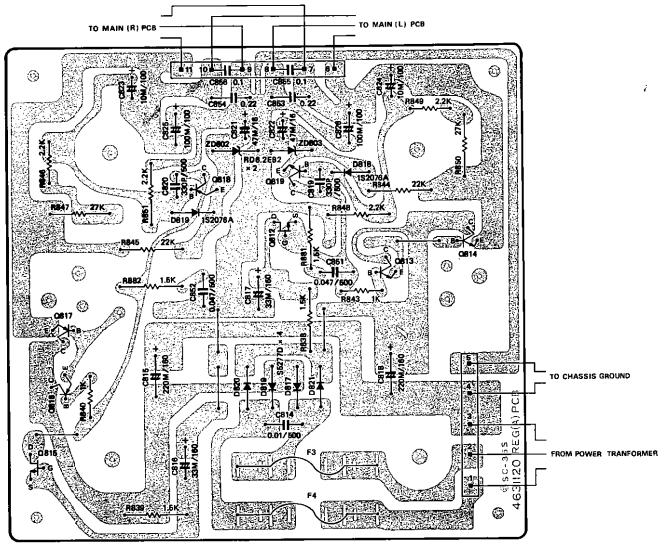
MAIN AMP (R) P.C.B.



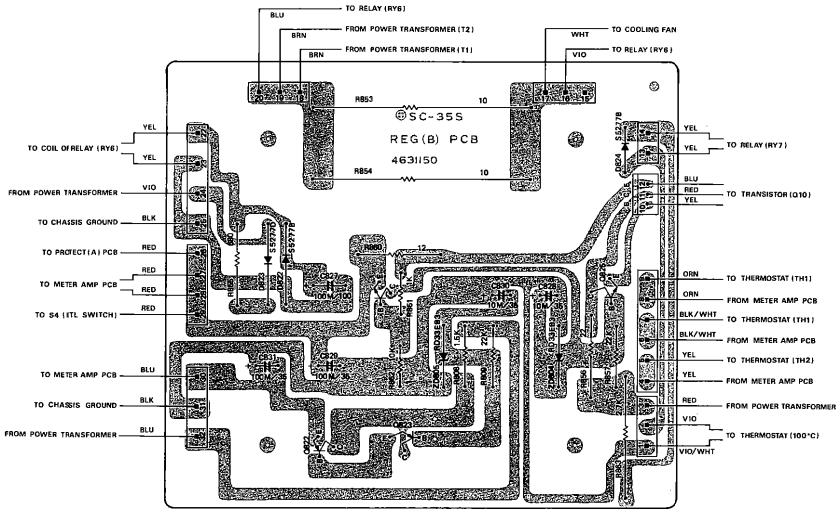
METER AMP P.C.B.



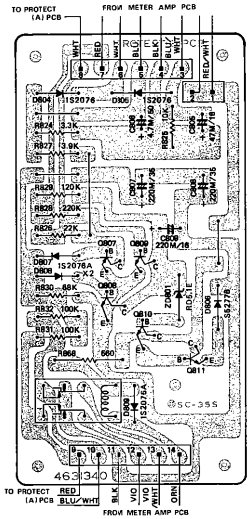
PROTECTOR (A) P.C.B.



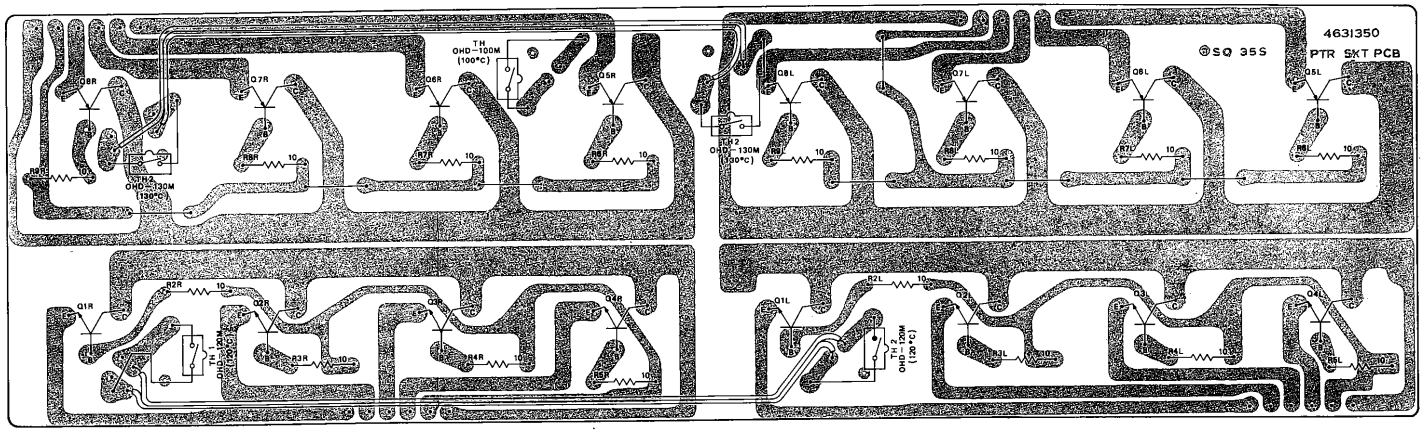
REGULATOR (A) P.C.B.



REGULATOR (B) P.C.B.

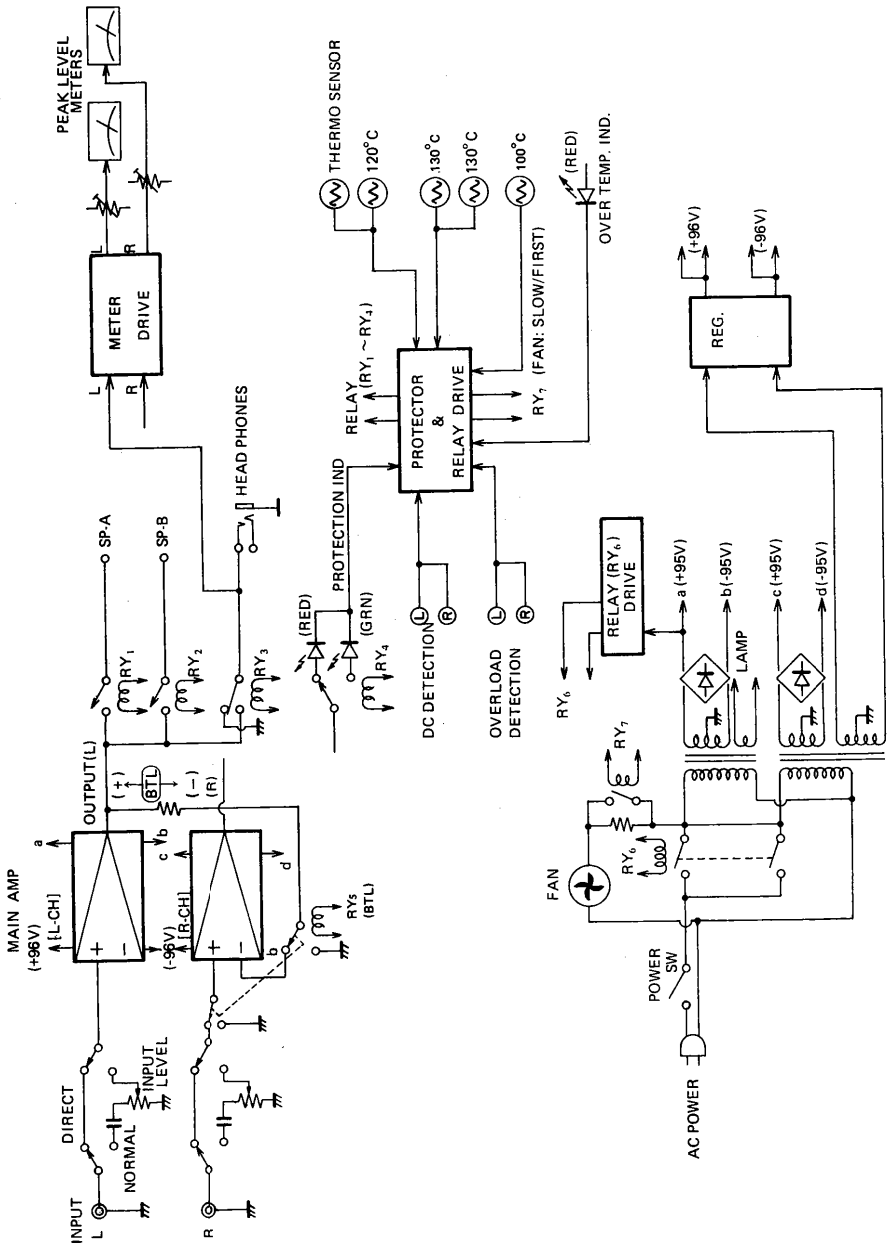


PROTECTOR (B) P.C.B.



POWER TRANSISTOR SOCKET P.C.B.

BLOCK DIAGRAM



POWER TRANSISTORS MOUNTING ASSEMBLY

NOTE: For best heat conduction, use thermally conductive silicon grease between the power transistor and the mica insulator and between the insulator and the heat sink.

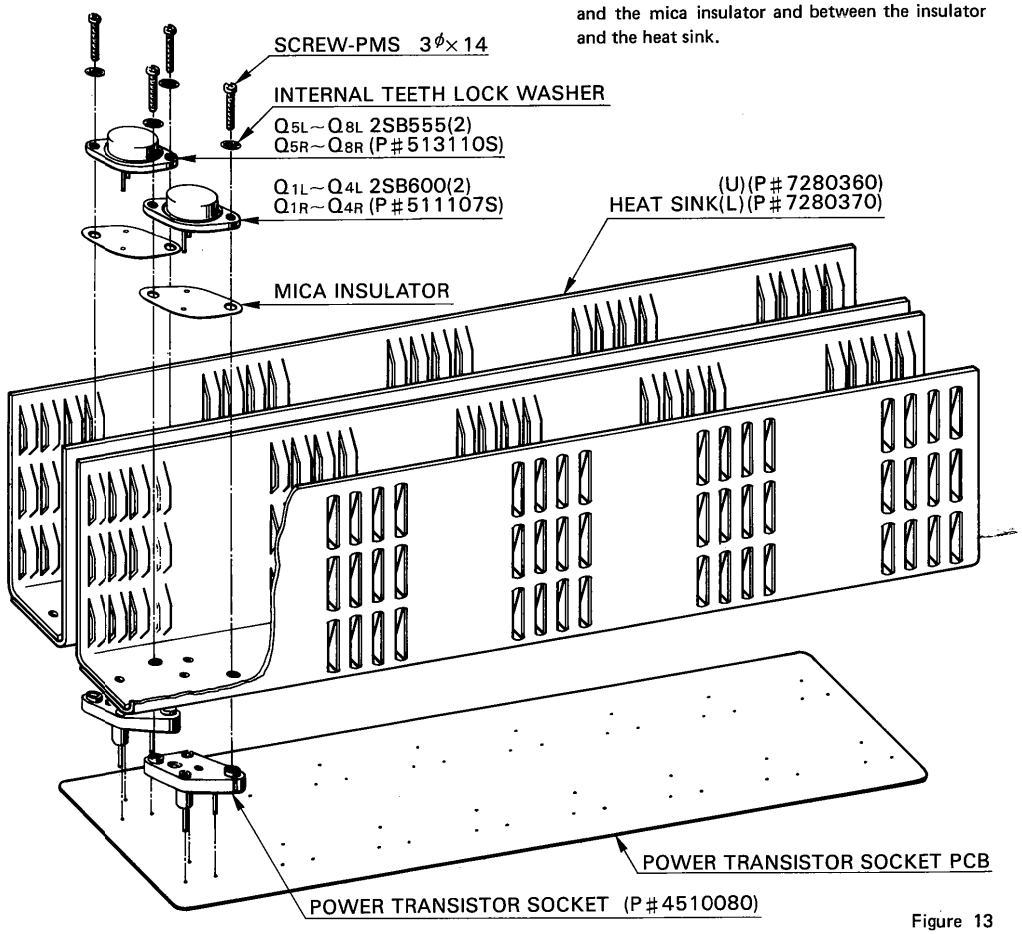


Figure 13

PRECAUTIONS FOR REPAIR SERVICE

Many of these items are included just as a reminder – they are normal procedures for experienced tecnicians. Short-cuts can be taken: but, often they cause additional damage to transistors, circuit components or the printed circuit board.

1. **Do not** bridge electrolytic capacitors with AC power. The resultant surges may damage solid state devices.
2. **Do not** bias the base of any transistor while voltage is being applied to its collector.
3. Replacements for output and driver transistors, if necessary, must be made from the same **hfe** group as the original type. Besure to include this information when ordering replacement transistors.
4. If one output transistor burns out (open or shorts), always remove **all** output transistors in that channel and check the bias adjustment, the control and other parts in the network with an ohmmeter before inserting a new transistor. All output transistors in one channel will be destroyed if the base biasing circuit is open in the emitter end.

PARTS LOCATION

NOTE: Numbers of three digits with a ◯ are related to the KEY NUMBERS on parts list.

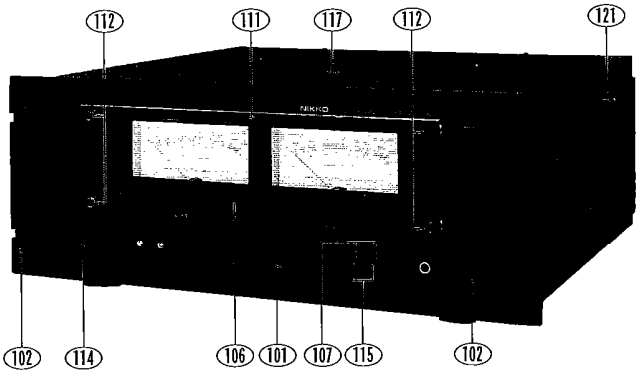


Photo 5

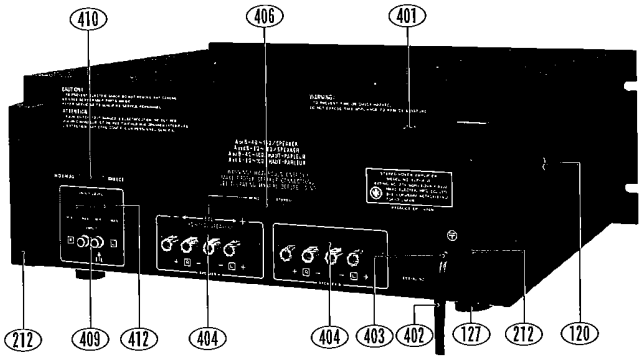


Photo 6

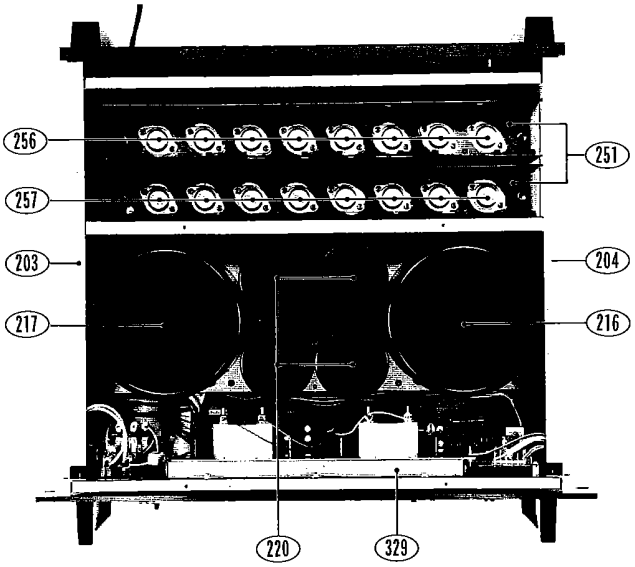


Photo 7

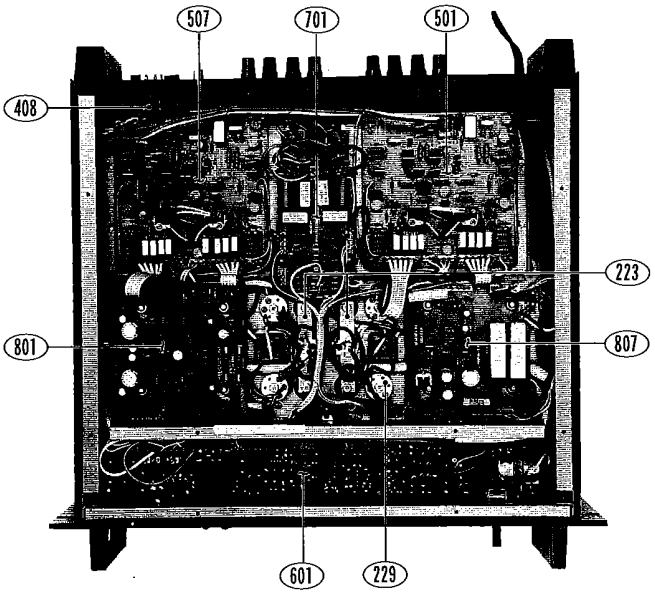


Photo 8

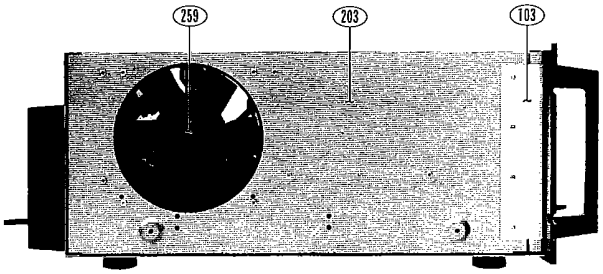


Photo 9

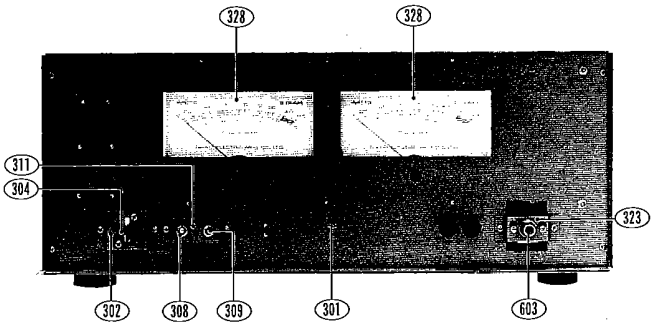


Photo 10

PARTS LIST

NOTE:

1. ★ The KEY NUMBER (#) marked with a (★) on parts list relate to number of three digits with a (◯). (Photo 5–10)
2. + Numberals in file indicate the quantity of parts used in one type.
3. ++ TR : Transistor
   FET : Field effect transistor
   VR : Volume control (Variable resistor)
   RES : Carbon film fixed resistor
   MO-RES : Metal oxide film fixed resistor
   CEM-RES : Cemented wirewound fixed resistor
   FP : Flame proof
   C-CAP : Ceramic capacitor
   E-CAP : Aluminum electrolytic capacitor
   M-CAP : Polyester film capacitor
   S-CAP : Polystyrene film capacitor
   T-CAP : Tantalum electrolytic capacitor
   BP-CAP : Bipolar electrolytic capacitor
   LC-CAP : Low current leakage electrolytic capacitor.
4. Assemblies and parts are subject to change without notice.
5. Parts ordering procedure:
   A. DO NOT USE THE "KEY" NUMBER AND "SYMBOL" NUMBER. (these are control #for the factory only)
   B. Include in any order
      a. Part number.
      b. Part description.
      c. Model number.

      (any of the above lacking from an order may delay shipment of that order.)

KEY NO.	SYMBOL NO.	TYPE + W E N	DESCRIPTION ++	PART NO.
			PACKING MATERIALS & ACCESSORIES	
001		1 1 1	Carton box	9825580
002		1 1 1	Pad, front	9840850
003		1 1 1	Pad, rear	9840860
004		1 1 1	Sack, polyethylen cloth	9640670
005		1 1 1	Sack, polyethylen cloth – #13	9640320
006a		1 – –	Manual, instruction – E	960282E
006b		– 1 1	Manual, instruction – K	960283K
007		1 – –	List, service stations	9690180
008		1 – –	Card, warranty	967009A
009		1 – –	Post card	967008A
010		1 1 1	Card, specifications	9690190
011		1 1 1	Cloth, polishing	9690040
012		1 1 1	Drier – silica gel	9690010
013		1 1 1	Cord, RCA phono pin plug – 2T-1 (NK)	962014A
			CABINET ASSEMBLY	
★101a		1 1 1	Panel, front – SILVER	7884520
★101b		1 1 1	Panel, front – BLACK	7884530
★102a		2 2 2	Handle – 120G, SILVER	7490200
★102b		2 2 2	Handle – 120B, BLACK	7490210
★103		2 2 2	Bracket, panel	7032770
104		4 4 4	Screw – PMS 6φx16	810616S
105		4 4 4	Washer – TW (I) 6φ	893406U
★106		1 1 1	Cover, meter	7401870
★107		2 2 2	Guide – 1P5, for push button	7401710
108		1 1 1	Dust cover, for power switch	7001760
109		1 1 1	Spacer, insulation – R	7002200
110		2 2 2	Spacer, insulation – H	7002210
★111		1 1 1	Window, panel	7802440
★112		4 4 4	Cup screw – 4φx16	7121040
113		8 8 8	Screw – PTS 3φx8	814308S
★114a		1 1 1	Knob – 15GL-8LS – power, SILVER	7841110
★114b		1 1 1	Knob – 16BK-8LS – power, BLACK	7841120
★115		2 2 2	Button – P5x15 – speakers	7852090
116		2 2 2	Shaft, extension – 26.5	7401730
★117		1 1 1	Cover, metal	7820960
118		1 1 1	Plate, radiation – L	7032730
119		1 1 1	Plate, radiation – R	7032740
★120		1 1 1	Grille, radiation – L	7032750
★121		1 1 1	Grille, radiation – R	7032760
122		8 8 8	Screw – PMS 3φx6	810306W
123		4 4 4	Screw – TFTS 4φx10	887410W
124		4 4 4	Washer – 4φ	893104W
125		6 6 6	Screw – PTS 3φx6	814306W
126		1 1 1	Plate, bottom	7325670
★127		4 4 4	Foot, polyethlen – 30φx14	7400780
128		4 4 4	Screw – PMS 5φx16	810516S
129		6 6 6	Screw – PTS 3φx6	814306W

KEY NO.	SYMBOL NO.	TYPE + W E N	DESCRIPTION ++	PART NO.
			CHASSIS ASSEMBLY	
201		1 1 1	Chasis, for power transformer	7325690
202		1 1 1	Chasis, for amplifier	7325700
★203		1 1 1	Angle, left side	7227040
★204		1 1 1	Angle, right side	7227050
205		2 2 2	Spacer, front panel	7400850
206		14 14 14	Screw – PTS 3φx6	814306S
207		2 2 2	Screw – PTS 3φx10	814310S
208		1 1 1	(FRONT PLATE ASSEMBLY)	
209		8 8 8	Screw – PTS 3φx6	814306S
210		1 1 1	(BACK PLATE ASSEMBLY)	
211		2 2 2	Screw – PTS 3φx6	814306S
212		2 2 2	Guard, rear	7402130
213		4 4 4	Screw – TFTS 4φx16	887416W
214		1 1 1	(REG.(A) PCB ASSEMBLY)	
215		4 4 4	Supportor, PCB	7401310
★216a	T1	1 – –	Transformer, power – T-1-321 – 120V only	1103210
★217a	T2	1 – –	Transformer, power – T-1-340 – 120V only	1103400
★216b	T1	– 1 1	Transformer, power – T-1-357 – 220/240V class II	1103570
★217b	T2	– 1 1	Transformer, power – T-1-358 – 220/240V class II	1103580
218		8 8 8	Washer – IN 6φ	892016S
219		8 8 8	Washer – 6φ	893406U
★220	C3 ~ C6	4 4 4	E-CAP 15000uf 115V	214951H
221		12 12 12	Screw – PMS 4φx8	810408S
222		12 12 12	Washer – TW (I) 4φ	893404U
★223		2 2 2	Buss bar	7050540
224		3 3 3	Lug, ground – 4P WP	4400100
225		15 15 15	Screw – PTS 3φx6	814306S
226		1 1 1	Screw – PTS 3φx10	814310S
227		12 12 12	Terminal, ground	4581580
228		16 16 16	Washer – TW (I) 3φ	893403U
★229		4 4 4	Lug, for E-CAP	7050550
230		2 2 2	FP-MO-RES 6.8kohm 5% 3W	363682F
231	D1,D2	2 2 2	Diode S15VB20	560045S
232		2 2 2	Screw – PTS 4φx16	814416S
233		3 3 3	Tye, nylon	7401880
234		1 1 1	Lug – 2L5P (S)	442251S
235		2 2 2	Bush	7401090
236	RY1, 2	2 2 2	Relay AMT2F-110HJ – DC24V	1700240
237		4 4 4	Screw – BLTS 3φx8	874308S
238		1 1 1	(PROTECTOR (A) PCB ASSEMBLY)	
239		4 4 4	Supportor, PCB	7401310

PART ORDERING PROCEDURE ----- DO NOT USE THE "KEY" NUMBER AND "SYMBOL" NUMBER. (these are control # for the factory only.) Include in any order: a. Part number, b. Part description, c. Model number. (any of the above lacking from an order may delay shipment of the order.)

KEY NO.	SYMBOL NO.	TYPE+ W E N	DESCRIPTION++	PART NO.
240		3 3 3	Connector, with wires – 3 pin female	4570360
241		4 4 4	Magnet – 1285	7903170
242		4 4 4	Shaft – 40L	7152430
243		8 8 8	Washer – IN 4φ	892014S
245		8 8 8	Washer – TW (I) 4φ	893404U
246		2 2 2	Lug, ground – 4φ	4400120
247		2 2 2	M-CAP 0.047uf 10% 400V	273473K
248		1 1 1	Connector, with wires – 3 pin female	4570360
249		2 2 2	(MAIN AMP PCB ASSEMBLY)	
250		8 8 8	Supportor, PCB	7401130
★251		2 2 2	Heat sink – (U)	7280360
252		2 2 2	Heat sink – (L)	7280370
253		9 9 9	Screw – PTS 3φx8	814308S
254		16 16 16	Socket, power transistor	4510080
255		1 1 1	(POWER TRANSISTOR SOCKET PCB ASSEMBLY)	
★256	Q1L, R			
	~ Q4L, R	8 8 8	TR 2SB600 (2) (R)	511107S
★257	Q5L, R			
	~ Q8L, R	8 8 8	TR 2SD555 (2) (R)	513110S
258	R2L, R			
	~ R9L, R	16 16 16	FP-MO-RES 10ohm 5% 1W	361100L
★259a		1 – –	Fan, cooling – AC 115V	9220020
★259b		– 1 1	Fan, cooling – AC 200V	9220030
260		4 4 4	Screw – PMS 3φx10	810310S
261		4 4 4	Washer – IN 3φ	892013S
262		4 4 4	Washer – TW (I) 3φ	893403U
263		2 2 2	Thermostat – OHD130M	4900930
264		2 2 2	Thermostat – OHD120M	4900940
265		1 1 1	Thermostat – OHD100M	4900960
266		5 5 5	Screw – PTS 3φx8	814308S
267	Q9L, R	2 2 2	TR 2SC1904 (B or V)	515087S
268	Q10	1 1 1	TR 2SD381 (L or M)	510038S
			FRONT PLATE ASSEMBLY	
★301		1 1 1	Plate, front	7325680
★302		1 1 1	Bracket, power switch	7031260
★303		2 2 2	Screw – PTS 3φx6	814306S
★304		1 1 1	Switch, lever – SY02 – power, dpst	4025420
305a		1 – –	C-CAP 0.0047uf AC 125V	239472C
305b		– 2 2	C-CAP 0.0047uf AC 250V	239472E
306		1 2 2	Cover, C-CAP – (M)	7400980
307		2 2 2	Screw – PMS 3φx5	810305S
★308		1 1 1	LED BU-188RG – red and green – protector	5060040
★309		1 1 1	LED BU-1138CD – red – hi-temp	5060150
310		2 2 2	Spacer, LED	7121050
★311		1 1 1	Bracket, LED – (A)	7032800
312		2 2 2	Screw – PTS 3φx6	814306S
313	F1, F2	2 – –	Fuse – 8A 250V MGC	4700700
314		2 – –	Holder, fuse – 1P	4581840
315		2 – –	Screw – PTS 3φx8	814308S
316	F1, F2	– 2 2	Midget fuse – (S) 5AT 250V	4720410
317		– 2 2	Holder, midget fuse – 1P	4581430
318		– 2 2	Screw – PTS 3φx6	814306S
319	RY6, 7	2 2 2	Relay – MAT 2F-DHJ	1700260
320		4 4 4	Screw – PTS 3φx8	814308S

KEY NO.	SYMBOL NO.	TYPE+ W E N	DESCRIPTION++	PART NO.
321	R1	1 1 1	CEM-RES 820ohm 5% 10W	386821K
322	C1	1 1 1	C-CAP 0.01uf 500V	238103P
★323		1 1 1	Bracket, head phones jack	7032790
324		4 4 4	Screw – PTS 3φx6	814306S
325		1 1 1	(METER AMP PCB)	
326		1 1 1	Screw – PTS 3φx6	814306S
327		2 2 2	Screw – PMS 3φx5	810305S
★328		2 2 2	Meter, power – L-55	4582260
★329		1 1 1	Holder, meter	7227030
330		1 1 1	Light guide, for meters	7002160
331		6 6 6	Screw – PTS 3φx6	814306S
332		1 1 1	(LAMP PCB SUB ASSEMBLY)	
333		4 4 4	Lamp – 8V 0.25A	5808160
334		3 3 3	Rivet, push – 3φx3.5	7401190
335		1 1 1	(PROTECT. (B) PCB ASSEMBLY)	
336		2 2 2	Stud screw – (B)	7121030
337		2 2 2	Washer – TW (I) 3φ	893403U
338		2 2 2	Washer – IN 3φ	892013S
339		2 2 2	Screw – PMS 3φx5	810305S
			BACK PLATE ASSEMBLY	
★401a		1 – –	Plate, back – W	7325580
★401b		– 1 1	Plate, back – N	7325590
★402a		1 – –	Plug/Cord – SPT-2	606008A
★402b		– 1 1	Plug/Cord – CEE-2T	600508A
★403		1 1 1	Bush, cord – SR-4N-4	7400690
★404		2 2 2	Terminal, speaker – screw type – 4P	4450490
405		4 4 4	Screw – PTS 3φx8	814308W
★406	S4	1 1 1	Switch, slide – ESD3996 – BTL	4020550
407		2 2 2	Screw – PMS 3φx6	810306W
★408		1 1 1	(INPUT PCB SUB ASSEMBLY)	
★409		1 1 1	Terminal, RCA phono pin jack – 2P, gold plated	4442060
★410	S5	1 1 1	Switch, slide – SSB-042 – input mode	4020560
411	R903,904	2 2 2	VR VM60Z 250kohm (B) – input level	4310570
★412		2 2 2	Knob – P2BK-16LVD – input level	7851800
413	C901,902	2 2 2	M-CAP 0.1uf 10% 50V	222104K
414	R901			
	~ R904	4 4 4	RES 1meg.ohm 5% ¼W	328105J
415		1 1 1	Shaft, GND terminal – MK-3	7152050
416		1 1 1	Nut, GND terminal – MK-2	7152060
417		1 1 1	Washer – 3φ	8932030
418		1 1 1	Washer – IN 3φ	892013S
419		1 1 1	Washer – TW (I) 3φ	893403U
			MAIN AMP PC BOARD ASSEMBLY – LEFT CHANNEL	
★501		1 1 1	MAIN AMP PCB ASSEMBLY – Left channel	9430710
502		1 1 1	Connector, 2 pin male – MC-2PM	4570240
503		1 1 1	Connector, 3 pin male – MC-3PM	4570250
504		2 2 2	Heat sink, for Q718, 720	7480320
505		4 4 4	Screw – PMS 3φx6	810306S
506		4 4 4	Washer – TW (I) 3φ	893403U
	Q701,702	2 2 2	TR 2SC2240 (GR or BL)	512102S

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KEY NO.	SYMBOL NO.	TYPE + W E N	DESCRIPTION ++	PART NO.
	Q703	1 1 1	FET 2SK150 (GR)	516035S
	Q704	1 1 1	TR 2SC2240 (GR or BL)	512102S
	Q705,706	2 2 2	TR 2SA872 (E)	510043S
	Q707			
	~ Q709	3 3 3	TR 2SA964A (P or Q)	510106S
	Q710,711	2 2 2	TR 2SC2224A (P or Q)	512110S
	Q712	1 1 1	TR 2SA733A (P or Q)	514074S
	Q713,714	2 2 2	TR 2SC945L (P or Q)	515077S
	Q715	1 1 1	TR 2SA733A (P or Q)	514074S
	Q716	1 1 1	TR 2SC2224A (P or Q)	512110S
	Q717	1 1 1	TR 2SA964A (P or Q)	510106S
	Q718	1 1 1	TR 2SC2336B (Q or R)	512111S
	Q719	1 1 1	TR 2SC1904 (B or V)	515087S
	Q720	1 1 1	TR 2SA1006B (Q or R)	510107S
	D701			
	~ D704	4 4 4	Diode 1S2076	501019S
	D705,706	2 2 2	Diode U05C	560054S
	D707	1 1 1	Diode STV-4H	505018S
	D708,709	2 2 2	Diode 1S2076	501019S
	D710,711	2 2 2	Diode S5277B	560046S
	D712,713	2 2 2	Diode 1S2076A	501020S
	D714,715	2 2 2	Diode S5277D	560047S
	ZD701	1 1 1	Zener diode RD6.2EB2	502048S
	ZD702	1 1 1	Zener diode RD9.1EB2	502055S
	C701	1 1 1	C-CAP 100pf 10% 50V SL	232101K
	C702,703		– DELETED –	
	C704	1 1 1	C-CAP 15pf 10% 500V SL	234150K
	C705	1 1 1	M-CAP 0.1uf 10% 100V	226104K
	C706	1 1 1	C-CAP 33pf 10% 500V SL	234330K
	C707	1 1 1	M-CAP 0.1uf 10% 250V	272104K
	C708	1 1 1	C-CAP 39pf 10% 500V SL	234390K
	C709	1 1 1	C-CAP 100pf 10% 500V SL	234101K
	C710,711	2 2 2	M-CAP 0.047uf 10% 250V	272473K
	C712	1 1 1	C-CAP 330pf 10% 500V SL	234221K
	C736	1 1 1	M-CAP 0.047uf 10% 400V	273473K
	R756	1 1 1	Potentiometer – SR19R B1kohm	4300720
	R757,758	2 2 2	Potentiometer – SR19R B10kohm	4300510
	R759,761	2 2 2	Potentiometer – SR19R B1kohm	4300720
	R762	1 1 1	Potentiometer – SR19R B100kohm	4301140
	R701	1 1 1	RES 1meg.ohm 5% ¼W	328105J
	R702	1 1 1	RES 120kohm 5% ¼W	328124J
	R703	1 1 1	RES 3.3kohm 5% ¼W	328332J
	R704	1 1 1	RES 1kohm 5% ¼W	328102J
	R705	1 1 1	RES 6.8kohm 5% ¼W	328682J
	R706	1 1 1	RES 3.9kohm 5% ¼W	328392J
	R707	1 1 1	RES 2.2kohm 5% ¼W	328222J
	R708	1 1 1	RES 39kohm 5% ¼W	328393J
	R709	1 1 1	RES 2.2kohm 5% ¼W	328222J
	R710	1 1 1	RES, metal film 620ohm 2% ¼W	304621G
	R711		– DELETED –	
	R712,713	2 2 2	FP-MO-RES 22kohm 5% 1W	361223L
	R714	1 1 1	FP-MO-RES 470ohm 5% ½W	360471F
	R715,716	2 2 2	FP-MO-RES 560ohm 5% ½W	360561L
	R717	1 1 1	FP-MO-RES 390ohm 5% ½W	360391L
	R718,719	2 2 2	FP-MO-RES 33ohm 5% ½W	360330L
	R720	1 1 1	RES, metal film 30kohm 2% ¼W	304303G
	R721	1 1 1	FP-MO-RES 470 ohm 5% ½W	360471F
	R722	1 1 1	RES 470ohm 5% ¼W	328470J
	R723		– DELETED –	
	R724,725	2 2 2	FP-RES 22ohm 5% ½W	329220L
	R726	1 1 1	FP-MO-RES 220ohm 5% ½W	360221L
	R727,728	2 2 2	RES 6.8kohm 5% ¼W	328682J
	R729	1 1 1	FP-RES 22ohm 5% ½W	329220L
	R730		– DELETED –	
	R731	1 1 1	FP-MO-RES 390ohm 5% ½W	360391L
	R732		– DELETED –	
	R733	1 1 1	FP-RES 22ohm 5% ½W	329220L
	R734	1 1 1	FP-MO-RES 390ohm 5% ½W	360391L
	R735,736	2 2 2	RES 33kohm 5% ¼W	328333J
	R737	1 1 1	FP-MO-RES 270ohm 5% ½W	360271L
	R739			
	~ R746	8 8 8	FP-RES 100ohm 5% ½W	329101L
	R747			
	~ R754	8 8 8	CEM-RES 0.33ohm 10% 5W	384339W
	R755		– DELETED –	
	R756			
	~ R759		(Potentiometer)	
	R760	1 1 1	RES, metal film 30kohm 2% ¼W	304303G
	R761,762		(Potentiometer)	
			MAIN AMP PC BOARD ASSEMBLY – RIGHT CHANNEL	
*507		1 1 1	MAIN AMP PCB ASSEMBLY – Right channel	9430720
	NOTE:		Parts are identical to the Left Channel with the exceptions as described below.	
508	RY5	1 1 1	Relay – RZ-24	1700280
509		1 1 1	Connector, with wires – 2pin female	4570300
510		1 1 1	Connector, with wires – 3pin female	4570350
	D716	1 1 1	Diode 1S2076A	501020S
	C737	1 1 1	BP-CAP 3.3uf 50V	215513N
	R765	1 1 1	FP-MO-RES 560ohm 5% ½W	360561L
			METER AMP PC BOARD ASSEMBLY	
*601a		1 – –	METER AMP PCB ASSEMBLY	9492710
*601b		– 1 1	METER AMP PCB ASSEMBLY	9492720
602	S2, S3	1 1 1	Switch, twin push – SUE23 – speakers	4040930
603		1 1 1	Jack, head phones – JL3A	4550260
604a	F2	1 – –	Fuse – 2A 250V MGC	4700620
605a		2 – –	Clip, fuse	7050420
604b	F2	– 1 1	Midget fuse – (S) 2AT 250V	4720370
605b		– 2 2	Clip, midget fuse	7050430
606	RY4	1 1 1	Relay LY2-0-US – DC24V	1700290
	IC801	1 1 1	IC TA7318P	518067S
	Q801			
	~ Q805	5 5 5	TR 2SC945L (P or Q)	515077S
	D801			
	~ D803	3 3 3	Diode 1S2076A	501020S
		2 2 2	Thermistor D2FHL-103S	5400180
	C801			
	~ C804	4 4 4	E-CAP 22uf 35V	211422V
	C832,833	2 2 2	M-CAP 0.015uf 10% 50V	222153K
	C834	1 1 1	M-CAP 0.047uf 10% 100V	226473K
	C835,836	2 2 2	C-CAP 0.01uf 500V	238103P
	C837			
	~ C840	4 4 4	E-CAP 10uf 50V	211520V
	R833,834	2 2 2	Potentiometer – SR19R B1kohm	4300720
	R801	1 1 1	FP-MO-RES 1.5kohm 5% 1W	361152L
	R802	1 1 1	FP-MO-RES 560ohm 5% 3W	363561L
	R803		– DELETED –	
	R804	1 1 1	RES 33kohm 5% ¼W	328333J
	R805	1 1 1	FP-MO-RES 560ohm 5% 3W	363561L
	R806	1 1 1	RES 390kohm 5% ¼W	328394J
	R807	1 1 1	RES 33kohm 5% ¼W	328154J
	R808	1 1 1	FP-MO-RES 1.5kohm 5% 1W	361152L
	R809	1 1 1	RES 390kohm 5% ¼W	328394J
	R810	1 1 1	FP-MO-RES 100ohm 5% ½W	360101L
	R811	1 1 1	FP-MO-RES 22ohm 5% ½W	360220L
	R812	1 1 1	RES 18kohm 5% ¼W	328183J
	R813		– DELETED –	
	R814	1 1 1	RES 6.8kohm 5% ¼W	328682J
	R815	1 1 1	RES 1kohm 5% ¼W	328102J

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KEY NO.	SYMBOL NO.	TYPE + W E N	DESCRIPTION ++	PART NO.
	R816		– DELETED –	
	R817	1 1 1	RES 47kohm 5% ¼W	328473J
	R818	1 1 1	RES 1.2meg.ohm 5% ¼W	328152J
	R819	1 1 1	RES 47kohm 5% ¼W	328473J
	R820,821	1 1 1	FP-MO-RES 2.2kohm 5% 1W	361222L
	R822	1 1 1	RES 22kohm 5% ¼W	328223J
	R823	1 1 1	RES 10ohm 5% ¼W	328100J
	R833,834		(Potentiometer)	
	R835	1 1 1	FP-MO-RES 150ohm 5% ½W	360151L
			PROTECTOR (A) PC BOARD ASSEMBLY	
★701		1 1 1	PROTECT. (A) PCB ASSEMBLY	9450840
★702	L801,802	2 2 2	Coil, choke – 1uh 1 12	1210810
★703		1 1 1	Connector, 3pin male – MC-3PM	4570250
	Q824,826	2 2 2	TR 2SC1941 (L or K)	512112S
	Q825	1 1 1	TR 2SA733A (P or Q)	514074S
	D810	1 1 1	Diode 1S2076	501019S
	D811,812	2 2 2	Diode 1S2076A	501020S
	D813,814	1 1 1	Diode 1S2076	501019S
	D815,825	2 2 2	Diode 1S2076A	501020S
	C811,812	2 2 2	M-CAP 0.01uf 10% 50V	222103K
	C813,814	2 2 2	M-CAP 0.047uf 10% 400V	273473K
	R866	1 1 1	RES 56kohm 5% ¼W	328563J
	R867	1 1 1	RES 12kohm 5% ¼W	328123J
	R868	1 1 1	RES 100kohm 5% ¼W	328104J
	R869	1 1 1	RES 10kohm 5% ¼W	328103J
	R870		– DELETED –	
	R871,872	2 2 2	RES 100ohm 5% ¼W	328101J
	R873		– DELETED –	
	R874		– DELETED –	
	R875,876	2 2 2	RES 470ohm 5% ¼W	328471J
	R877		– DELETED –	
	~ R880	4 4 4	CEM-RES 10ohm 10% 5W	384100K
	R881,882		– DELETED –	
	R883	1 1 1	RES 15kohm 5% ¼W	328153J
	R884,885	2 2 2	FP-MO-RES 150ohm 10% ½W	360151L
			PROTECTOR (B) PC BOARD ASSEMBLY	
★704		1 1 1	PROTECT. (B) PCB ASSEMBLY	4631340
★705	RY3	1 1 1	Relay RZ-24 – DC24V	1700280
★706		1 1 1	Heat sink, for Q811	510038S
★707		2 2 2	Screw – PMS 3φx6	810306S
★708		2 2 2	Washer – TW (I) 3φ	893403U
	Q807	1 1 1	TR 2SA733A (P or Q)	514074S
	Q808			
	~ Q810	3 3 3	TR 2SC945L (P or Q)	515077S
	Q811	1 1 1	TR 2SD381 (L or M)	510038S
	D804,805	2 2 2	Diode 1S2076	501019S
	D806	1 1 1	Diode S5277B	560046S
	ZD801	1 1 1	Zener diode RD5.1E	502045S
	C805	1 1 1	E-CAP 47uf 16V	211225Q
	C806	1 1 1	E-CAP 4.7uf 50V	211515V
	C807,808	2 2 2	E-CAP 220uf 35V	211432S
	C809	1 1 1	E-CAP 220uf 16V	211232Q
	R825	1 1 1	RES 10kohm 5% ¼W	328103J
	R826	1 1 1	RES 22kohm 5% ¼W	328223J
	R827	1 1 1	RES 3.9kohm 5% ¼W	328392J
	R828	1 1 1	RES 220kohm 5% ¼W	328224J
	R829	1 1 1	RES 120kohm 5% ¼W	328124J
	R830	1 1 1	RES 68kohm 5% ¼W	328682J
	R831,832	2 2 2	RES 100kohm 5% ¼W	328104J
	R868	1 1 1	FP-MO-RES 560ohm 5% ½W	360561L
			REGULATOR (A) PC BOARD ASSEMBLY	
★801a		1 – –	REG. (A) PCB ASSEMBLY	9450820
★801b	801	– 1 1	REG. (A) PCB ASSEMBLY	9450830
★802a	F3, 4	2 – –	Fuse – 1A 250V MGC	4700590
★803a		4 – –	Clip, fuse	7050420
★802b	F3, 4	– 2 2	Midget fuse – (S) 1AT 250V	4720330
★803b		– 4 4	Clip, midget fuse	7050430
★804		2 2 2	Heat sink, for Q814, 817	7480320
★805		4 4 4	Screw – PMS 3φx6	810306S
★806		4 4 4	Washer – TW (I) 3φ	893403U
	Q812	1 1 1	FET 2SK68A (L)	516023S
	Q813	1 1 1	TR 2SC1941 (L or K)	512112S
	Q814	1 1 1	TR 2SD381 (2) (L or M)	513073S
	Q815	1 1 1	FET 2SK68A (L)	516023S
	Q816	1 1 1	TR 2SA916 (L or K)	510108S
	Q817	1 1 1	TR 2SB536 (2) (L or M)	512051S
	Q818	1 1 1	TR 2SA916 (L or K)	510108S
	Q819	1 1 1	TR 2SC1941 (L or K)	512112S
	D816,817	2 2 2	Diode S5277D	560047S
	D818,819	2 2 2	Diode 1S2076A	501020S
	D820,821	2 2 2	Diode S5277D	560047S
	ZD802,803	2 2 2	Zener diode RD6.2EB2	502048S
	C814	1 1 1	C-CAP 0.01uf 500V	238103P
	C815	1 1 1	E-CAP 220uf 160V	217932Q
	C816,817	2 2 2	E-CAP 33uf 160V	211923V
	C818	1 1 1	E-CAP 220uf 160V	217932Q
	C819,820	2 2 2	C-CAP 330pf 10% 500V SL	234331K
	C821,822	2 2 2	E-CAP 47uf 16V	211225V
	C823,824	2 2 2	E-CAP 10uf 100V	211820V
	C825,826	2 2 2	E-CAP 100uf 100V	211830V
	C851,852	2 2 2	M-CAP 0.047uf 10% 200V	272473K
	C853,854	2 2 2	M-CAP 0.22uf 10% 100V	226224K
	C855,856	2 2 2	M-CAP 0.1uf 10% 100V	226104K
	R838,839	2 2 2	FP-MO-RES 1.5kohm 5% ½W	360152L
	R840	1 1 1	RES 1kohm 5% ¼W	328102J
	R841,842	2 2 2		
	R843	1 1 1	RES 1kohm 5% ¼W	328102J
	R844,845	2 2 2	FP-MO-RES 22kohm 5% 1W	361223L
	R846	1 1 1	RES 2.2kohm 5% ¼W	328222J
	R847	1 1 1	FP-MO-RES 27kohm 5% ½W	360273L
	R848	1 1 1	FP-MO-RES 2.2kohm 5% ½W	360222L
	R849	1 1 1	RES 2.2kohm 5% ¼W	328222J
	R850	1 1 1	FP-MO-RES 27kohm 5% ½W	360273L
	R851	1 1 1	FP-MO-RES 2.2kohm 5% ½W	360222L
			REGULATOR (B) PC BOARD ASSEMBLY	
★807		1 1 1	REG. (B) PCB ASSEMBLY	9450830
★808		1 1 1	Connector, 3pin male – MC-3PM	4570250
	Q822	1 1 1	TR 2SB536 (L or M)	510039S
	Q823	1 1 1	TR 2SA970 (GR or BL)	510048S
	Q824,825	2 2 2	TR 2SC2240 (GR or BL)	512102S
	D822,824	2 2 2	Diode S5277B	560046S
	D823	1 1 1	Diode S5277D	560047S
	ZD804,805	2 2 2	Zener diode HZ33-02	502039S
	C827	1 1 1	E-CAP 100uf 100V	211830V
	C828,830	2 2 2	E-CAP 10uf 35V	211420V
	C829,831	2 2 2	E-CAP 100uf 35V	211430V

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KEY NO.	SYMBOL NO.	TYPE + W E N	DESCRIPTION ++			PART NO.
	R853,854	2 2 2	CEM-RES 10ohm	10%	15W	387100K
	*R855	1 1 1	FP-MO-RES 680ohm	5%	3W	363681L
	R856	1 1 1	FP-MO-RES 22ohm	5%	2W	362220L
	R857	1 1 1	FP-MO-RES 22kohm	5%	1W	361223L
	R858	1 1 1	FP-MO-RES 1.5kohm	5%	1W	361152L
	R859	1 1 1	FP-MO-RES 22kohm	5%	1W	361223L
	R860	1 1 1	FP-MO-RES 12ohm	5%	2W	362120L
	R861	1 1 1	RES 1kohm	5%	¼W	328102J
	R862	1 1 1	RES 10kohm	5%	¼W	328103J
	R863	1 1 1	FP-MO-RES 2.7kohm	5%	3W	363272L

SEMICONDUCTOR DATA

TRANSISTORS

† NOTES Ge: Germanium Si: Sillicon

A: Alloy B: Base D: Diffused Dd: Double-diffused

Df: Drift-field E: Epitaxial G: Grown J: Junction

M: Mesa P: Planer Pc: Point-contact Td: Triple-diffused

DEVICE TYPE	APPLICATIONS	STRUCTURE†	MAXIMUM RATINGS Absolute-Maximum Values: (T_A = 25°C unless otherwise specified) Collector-to-Base Voltage V_{CBO} (V)	Emitter-to-Base Voltage V_{EBO} (V)	Collector Current I_C (mA)	Collector Dissipation P_C (mW)	Junction Temperature T_J (°C)	ELECTRICAL CHARACTERISTICS Typical Values: (T_A = 25°C unless otherwise specified) Collector Cutoff Current I_{CBO} (uA)	V_{CB} (V)	Static Forward-Current Transfer Ratio h_{FE}	V_{CE} (V)	I_C (mA)	Collector-Emitter Saturation Voltage $V_{CE(sat)}$ (V)	I_C (mA)	I_B (mA)	Gain-Bandwidth Product f_T $f_{\alpha b}$* (MHz)	V_{CE} V_{CB}* (V)	I_E I_C* (mA)	Output Capacitance C_{ob} (pF)	Others	MANUFACTURER
2SA733A (P, Q)	AF	PNP Si-E	−60	−5	−100	250	125	−0.1 max.	−60	135 ~ 400	−6	−1	−0.3 max.	−100	−10	450 max.	−6	10	6 max.		NEC
2SA872 (E)	AF, Low noise	PNP Si-E	−90	−5	−50	300	125	−0.5 max.	−75	400 ~ 800	−12	−2	−0.5 max.	−10	−1	120	−12	2	1.8		HITACHI
2SA916 (L, K)	AF	PNP Si-E	−160	−5	−50	800	150	−0.1 max.	−160	135 ~ 400	−10	−10	−0.6 max.	−20	−2	80	−10	10	3.5 max.	Complementary to 2SC1941	NEC
2SA964A (P, Q)	AF, Driver	PNP Si-E	−250	−5	−200	1.5W	150	−1 max.	−200	160 ~ 200	−10	−1	−2 max.	−50	−5	100	−10	10	3	Complementary to 2SC2224A	NEC
2SA970 (GR, BL)	AF, Low noise	PNP Si-E	−120	−5	−100	300	125	−0.1 max.	−120	200 ~ 700	−6	−2	−0.3 max.	−10	−1					Complementary to 2SC2240	TOSHIBA
2SA1006B (Q, R)	AF, Driver	PNP Si-E	−250	−5	−1.5A	20W (Tc=25°C)	150	−1 max.	−150	100 ~ 120	−5	−5	−1 max.	−500	−50	80	−10	−0.1A*	45	Complementary to 2SC2336B	NEC
2SB536 (2) (L, M)	AF, Power amp	PNP Si-E	−150	−5	−1.5A	20W (Tc=25°C)	150	−1 max.	−120	60 ~ 160	−5	−5	−2 max.	−1A	−0.1A	40	−5	−0.1A*	40	Complementary to 2SD381 (2)	NEC
2SB600 (2) (R)	AF, Power amp	PNP Si-Td	−250	−5	−10A	200W (Tc=25°C)	150	−50 max.	−200	60 ~ 120	−5	−50	−3 max.	−10A	−1A	14	−5	−0.2A*	450	Complementary to 2SD555 (2)	NEC
2SC945L (P, Q)	AF	NPN Si-E	60	5	100	250	125	0.1 max.	60	135 ~ 400	6	1	0.3 max.	100	10	450 max.	6	−10	5 max.		NEC
2SC1904 (B, V)	AF	NPN Si-EP	150	5	50	1W	150	1 max.	140	100 ~ 350	5	10	0.5 max.	10	1	130	5	−10	2		FUJITSU
2SC1941 (L, K)	AF	NPN Si-E	160	5	50	800	150	0.1 max.	160	135 ~ 400	10	10	0.6 max.	20	2	120	10	−10	3 max.	Complementary to 2SA916	NEC
2SC2224A (P, Q)	AF, Driver	NPN Si-E	250	5	200	1.5W	150	1 max.	−200	160 ~ 200	10	1	2 max.	10	1					Complementary to 2SA964A	NEC
2SC2240 (GR, BL)	AF, Low noise	NPN Si-E	120	5	100	300	125	0.1 max.	120	200 ~ 700	6	2	0.3 max.	10	1					Complementary to 2SA970	TOSHIBA
2SC2336B (Q, R)	AF, Driver	NPN Si-E	250	5	1.5A	20W (Tc=25°C)	150	1 max.	150	100 ~ 120	5	5	1 max.	500	50	95	10	0.1A*	30	Complementary to 2SA1006B	NEC
2SD381 (L, M)	AF, Power amp	NPN Si-E	130	5	1.5A	20W (Tc=25°C)	150	1 max.	120	60 ~ 160	5	5	2 max.	1A	0.1A	45	5	0.1A*	25		NEC
2SD381 (2) (L, M)	AF, Power amp	NPN Si-E	150	5	1.5A	20W (Tc=25°C)	150	1 max.	120	60 ~ 160	5	5	2 max.	1A	0.1A	45	5	0.1A*	25	Complementary to 2SB536 (2)	NEC
2SD555 (2) (R)	AF, Power amp	NPN Si-Td	250	5	10A	200W (Tc=25°C)	150	50 max.	200	60 ~ 120	5	50	3 max.	10A	1A	15	5	0.2A*	300	Complementary to 2SB600 (2)	NEC

FIELD EFFECT TRANSISTORS

DEVICE TYPE	APPLICATIONS	STRUCTURE†	MAXIMUM RATINGS Absolute-Maximum Values: (T_A = 25°C unless otherwise specified) Gate-to-Drain Voltage V_{GDO} (V)	Gate-to-Source Voltage V_{GSO} (V)	Gate Current I_G (mA)	Drain Current I_D (mA)	Total Dissipation P_D (mW)	Channel Temperature T_{ch} (°C)	ELECTRICAL CHARACTERISTICS Typical Values: (T_A = 25° C unless otherwise specified) Gate Leak Current Test Conditions	I_{GSS} (nA)	Gate to Drain Breakdown Voltage Test Conditions	$V_{(BR)GDO}$ (V)	Drain Current Test Conditions	I_{DSS} (mA)	Gate to Source Cutoff Voltage Test Conditions	$V_{GS(off)}$ (V)	Forward Transfer Admittance Test Conditions	$\lvert Y_{fs}\rvert$ (mS)	Feed Back Capacitance Test Conditions	C_{rss} (pF)	Power Gain (Common Source) Test Conditions	G_{PS} (dB)	Noise Figure (R_g = 1 kΩ) Test Conditions	NF (dB)	MANUFACTURER
2SK68A (L)	AF, Low noise	Si N-channel junction	−50	−50	10	20	250	125	V_{GS} = −20V	1 max.			V_{DS} = 10V	1~3	V_{DS} = 10V I_D = 10μA	−1.5 max.	12	V_{DS} = 10V V_{GS} = 0 f = 1 kHz	2.6			V_{DS} = 10V V_{GS} = 0 f = 1 kHz	0.6	NEC
2SK150 (GR)	AF, Low noise Differential amp	Si Dual N-channel junction	−50	−50	10	14	200/ unit	125	V_{GS} = −30V	1 max.	I_G = −100μA	−50 min.	V_{DS} = 10V	2.6 ~6.5			12	V_{DS} = 10V V_{GS} = 0 f = 1 kHz	3			V_{DS} = 10V I_D = 0 f = 1 MHz	2 max.	V_{DS} = 10V I_D = 1mA f = 1 kHz		TOSHIBA

ZENER DIODES

DEVICE TYPE	APPLICATIONS	STRUCTURE†	MAXIMUM RATINGS Absolute - Maximum Values: (T_A = 25°C unless otherwise specified) Total Power Dissipation P_D (mW)	Zener Current I_Z (A)	Junction Temperature T_J (°C)	ELECTRICAL CHARACTERISTICS Typical Values: (T_A = 25°C unless otherwise specified) Zener Voltage V_Z MIN (V)	TYP (V)	MAX (V)	Test Conditions I_Z (mA)	Differential Resistance r_Z TYP (Ω)	MAX (Ω)	Test Conditions I_Z (mA)	Temperature Coefficient γ_Z TYP (%/°C)	MAX (%/°C)	Test Conditions I_Z (mA)	Reverse Current I_Z MAX (μA)	Test Conditions V_R (V)	Others	MANUFACTURER
RD5.1E	Regulator	Si-J	400		175	4.81		5.37	20		30	20				5	1.5		NEC
RD6.2-EB1	Regulator	Si-J	400		175	5.78		6.09	20		20	20				5	3		NEC
RD6.2-EB2	Regulator	Si-J	400		175	5.96		6.27	20		20	20				5	3		NEC
RD9.1-EB2	Regulator	Si-J	400		175	8.57		9.01	20		10	20				2	6		NEC
HZ33-02	Regulator	Si-EP	400		175	31.00		32.80	2	79	120	2				1	25		HITACHI

DIODES, LED'S

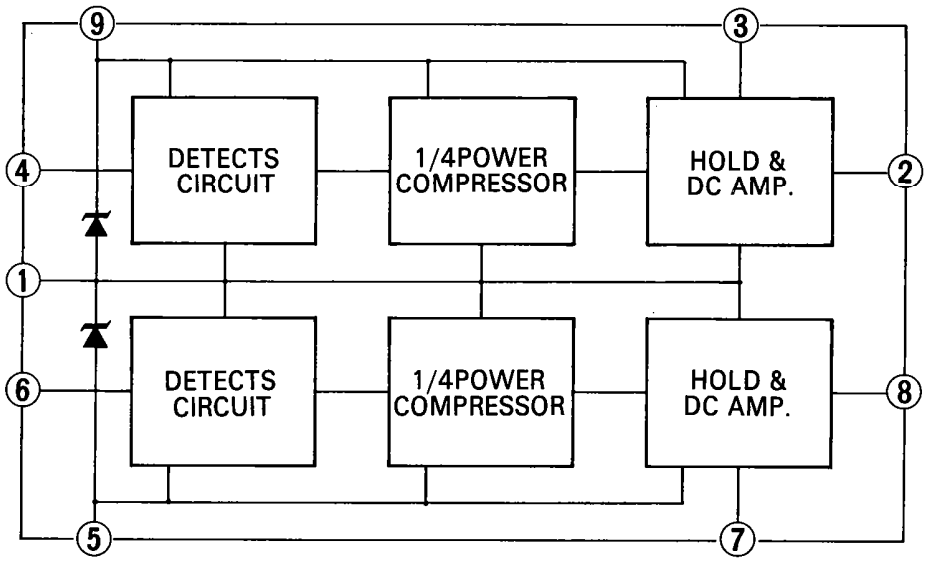
DEVICE TYPE	APPLICATIONS	STRUCTURE†	MAXIMUM RATINGS Absolute - Maximum Values: (T_A = 25°C unless otherwise specified)									ELECTRICAL CHARACTERISTICS Typical Values: (T_A = 25°C unless otherwise specified)							MANU-FACTURER
			Reverse Surge Voltage V_{Rsurge} (V)	Peak Reverse Voltage V_{RM} (V)	Reverse Voltage V_R (V)	Peak Forward Voltage V_{FM} (V)	Peak Forward Current I_{FM} (mA)	Average Rectified Current I_O (mA)	Forward Surge Current $I_{F\ surge}$ (A)	Junction Temperature T_J (°C)	Total Power Dissipation P_D (mW)	Forward Current I_{Fmin} (mA)	Test Condition V_F (V)	Forward Voltage V_{Fmax} (V)	Test Condition I_F (mA)	Reverse Current I_{Rmax} (uA)	Test Condition V_R (V)	Others	
S15VB20	Rectifier	Si-DJ Bridge		200				15A		150									SHINDENGEN
S5277B	Rectifier	Si-DJ		100			2A	1A	50	150				1.2	1A	10	100		TOSHIBA
S5277D	Rectifier	Si-DJ		200			2A	1A	50	150				1.2	1A	10	100		TOSHIBA
1S2076	Detector	Si-EP		35	30		450	150						0.8	10	1	30		HITACHI
1S2076A	Detector	Si-EP		70	60		450	150						0.8	10	1	30		HITACHI
U05C	Rectifier	Si-DJ		200				2.5A	100	175				1.1	2.5A				HITACHI
STV-4H	Temperature compensator	Si-DJ		10	50			100	18	125				2.35	7	10	5	Varistor	SANKEN
BU188-RG	Lamp (RED/GREEN)	GaP-J			4			I_F = 30 mA		100	75			2.4 (RED) 2.8 (GRN.)	10 20	10	4	500μcd (RED) (I_F = 10 mA) 1000μcd (GRN.) (I_F = 20 mA)	STANLEY
BU1138-CD	Lamp (RED)	GaP			4			IF = 50 mA		100	100			2.0	20	100	4	2000μcd (I_F = 20 mA)	STANLEY

INTERGRATED CIRCUITS TA-7318P

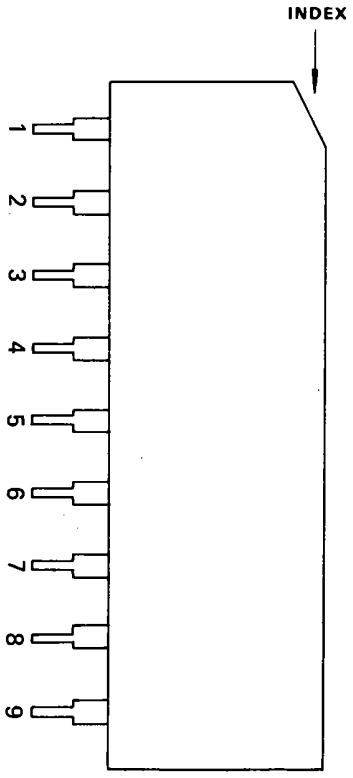
FUNCTION/MANUFACTURER

- **Dual Linear-to-Log Converter for Peak Power Meter/Toshiba**

BLOCK DIAGRAM AND CONNECTION INFORMATION



BLOCK DIAGRAM



TERMINAL GUIDE (SIDE VIEW)

CORRECTION OF SCHEMATIC DIAGRAM

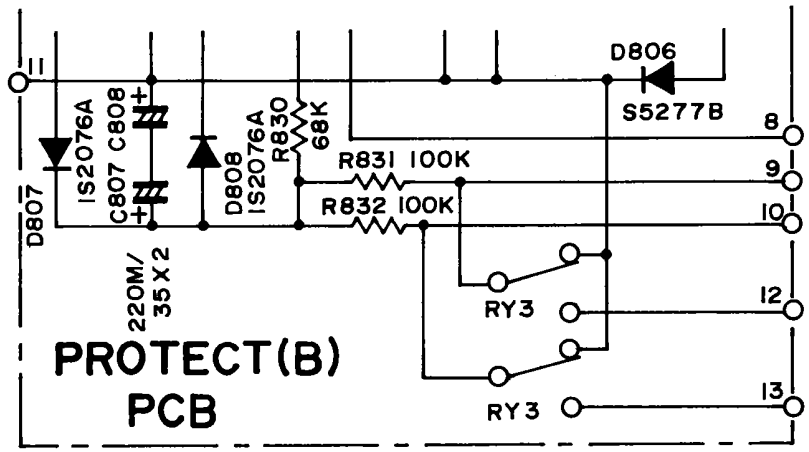
There are mistakes in the schematic diagram. Please make corrections as follows:

1. Main Amplifier Section
   A name of the transistor in the second stage of left channel should be:

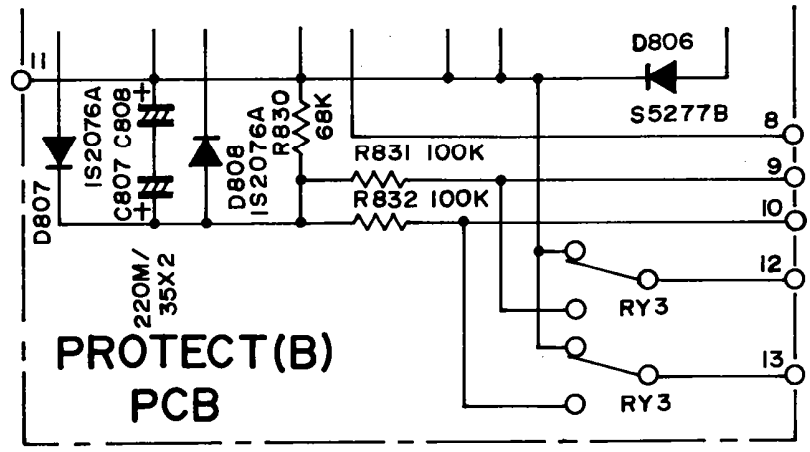
   Q9L 2SC2224A → Q9L 2SC1904

2. Protector Circuit (PROTECT B PCB)
   The circuit of the relay, RY3, is a mistake. See the following diagram.

Previous Diagram



Corrected Diagram



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